(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/41024 A1

(51) International Patent Classification[7]: G06F 17/60

(21) International Application Number: PCT/US00/32832

(22) International Filing Date: 1 December 2000 (01.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/168,400 1 December 1999 (01.12.1999) US

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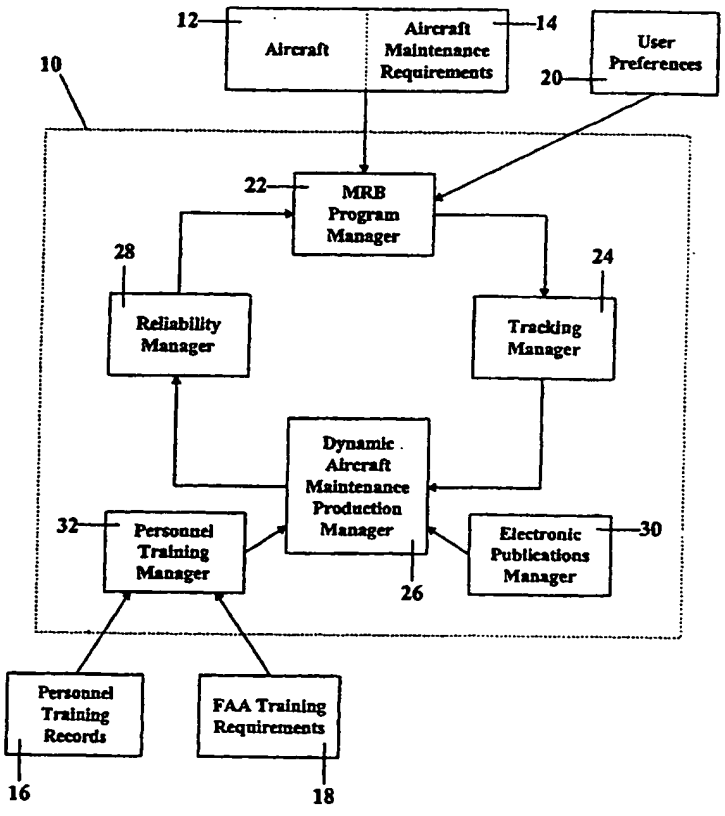
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian

[Continued on next page]

(54) Title: DYNAMIC AIRCRAFT MAINTENANCE MANAGEMENT SYSTEM



(57) Abstract: The present invention is a system (10) for enabling an operator to dynamically manage maintenance of an aircraft. The system (10) includes a program manager system (22), a tracking manager system (24) and a production manager system (26). The program manager system (22) is for extracting maintenance tasks from aircraft maintenance publications (14), and for guiding the formation of maintenance tasks groups. The tracking manager system (24) is for monitoring accumulated usage data of the aircraft, and for identifying maintenance due tasks and maintenance due task groups from the respective maintenance tasks and maintenance task groups for which a difference between the control point and the accumulated usage data is less than a user-defined critical value. The production manager system (26) is for generating and implementing a dynamic maintenance flow chart which details scheduling data for each individual task of the maintenance due tasks and maintenance due task groups.

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patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— *With international search report.*

— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DYNAMIC AIRCRAFT MAINTENANCE MANAGEMENT SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to the field of aircraft maintenance. More specifically, the present invention relates to a system and method for enabling an operator to dynamically manage maintenance of an aircraft.

Aircraft maintenance occupies a key position in airline operation because such maintenance is essential to the safety of passengers and the reliability of airline schedules. Each aircraft has its own maintenance requirements which are designed to keep the aircraft in an airworthy condition. These aircraft maintenance requirements typically originate from the aircraft's manufacturer, and can be revised throughout the life of the aircraft by the aircraft manufactures, the Federal Aviation Administration (FAA) and/or the Maintenance Review Board (MRB).

These aircraft maintenance requirements are documented in aircraft-specific MRB documents. An MRB document details each task that must be accomplished on a particular aircraft, the requirements of that task, and the frequency with which the task must be performed. The MRB document includes tasks that need to be accomplished anywhere from once a day to once every 20 years, as well as tasks that need to be accomplished after the aircraft has achieved a specific number of flight hours, flight cycles or other triggering indicia. For most major aircraft types, the MRB document lists somewhere between 800 to 2,000 different tasks.

The MRB document details a very complicated maintenance schedule. To ensure compliance with the MRB document, airlines must implement various tracking programs to monitor for the dates when tasks come due, as well as to log the completion of those tasks and any corrective actions taken.

Because an aircraft produces revenue only when it is flying, it is essential for airline management to keep maintenance time

at a minimum. Thus, airlines commonly group tasks together (into letter-checks) rather than perform the tasks one at a time as they come due. Letter checks commonly include "A checks", "B checks", "C checks" and "D checks", with A checks occurring most frequently and having the fewest number of tasks. A and B checks typically can be performed overnight in a "line maintenance" environment, in which, assuming no complications arise, the aircraft typically loses little or no flight time. In this environment, the aircraft remains airworthy because it can be reassembled quickly.

Conversely, C and D checks comprise a greater number of tasks, many of which require a substantial amount of time to complete. Thus C and D checks are typically performed in a heavy maintenance environment in which the aircraft is taken out of service. In this environment, an aircraft is taken into a hanger, where it is taken apart, inspected, fixed and reassembled during the course of one week to over a month. During this heavy maintenance period, non-routine tasks (those not detailed in the MRB document) are identified (often as a result of an inspection mandated by the MRB document), and parts that have reached their hard limits specified by the MRB document are replaced. Upwards of 300 persons (including cleaners, mechanics, lead mechanics, inspectors and lead inspectors) may work on the maintenance of the aircraft. In addition, a management team including managers, supervisors, directors, production coordinators and shops managers coordinate the completion of the maintenance. This maintenance team typically works in three shifts a day, seven days a week, to complete the needed maintenance.

To minimize the number of days the aircraft is removed from operation, a maintenance plan must be developed to assign and monitor the completion of tasks. The development of such a plan is made more difficult by the identification of non-routine tasks during the maintenance, back orders on parts which preclude the completion of certain tasks and the failure to complete timely critical path tasks (those

which prevent subsequent tasks from being completed). No computer-based method exists to dynamically prepare such a maintenance plan using dynamically changing information, such as available labor hours, sequence and dependency of tasks, and the addition of non-routine tasks.

Airlines can further save costs by escalating, when permissible, the intervals at which tasks are performed. Based upon reliability data collected by an airline during maintenance of their own aircrafts, the FAA may allow the airline to more favorably escalate tasks beyond the requirements of the MRB document (i.e, require the task to be performed at longer intervals). Thus, if a task to inspect a particular part is performed as required every six months, and the part is consistently (throughout the fleet) in good condition, the task may be escalated to one a year (or some other interval). Such escalations of tasks can significantly affect the time and cost of maintaining an airline's fleet of aircraft. A reliability program thus modifies, for a particular airline only, an aircraft's MRB document by changing the intervals required between overhauls, inspections and checks of aircraft equipment. Guidance on reliability program elements is listed in Advisory Circular (AC) 120-17, Maintenance Program Management Through Reliability Methods, as amended, the Airline/Manufacturer Maintenance Program Planning Document, MSG-2/3, and/or Maintenance Tasks.

A reliability program can further help airlines determine whether individual warrantied parts have met the manufacturer's predicted life limits. Often, manufacturers of aircraft parts, especially engine parts, guarantee that the part will not fail before a specified number of hours. Thus, a reliability program can enable airlines to get warranty money back from warranty administration on that part if the part does not meet the manufacturer's predicted life limits. There is no computer-based program for monitoring the reliability program of an entire fleet of aircraft as it relates to the requirements of the MRB

document, which uses data dynamically collected during the process of maintenance.

Another aspect of an aircraft maintenance program for an airline is the proper training of its personnel. The FAA has very strict standards regarding the training required of aircraft mechanics. Before permitting a mechanic to perform a task, the FAA requires that the mechanic have been previously supervised doing the task or specifically trained for the task. The FAA additionally requires much of the training to be performed on a recurrent basis. Therefore, airlines must monitor and log all training received by its maintenance employees.

Airlines must also maintain a significant number of publications, such as the MRB document, training manuals, maintenance manuals, illustrated parts catalogs, structural repair manuals, aircraft wiring diagrams and a general engineering and maintenance manual. Presently, these documents are mostly maintained in paper format.

No system presently exists to integrate all of the above-listed facets of a successful aircraft maintenance program. Additionally, no system presently exists to dynamically manage an aircraft's MRB document, to dynamically monitor for the dates when tasks are due on an aircraft, to log the completion of tasks and corrective actions taken on an aircraft, to dynamically prepare a maintenance plan, to dynamically collect reliability data or to dynamically collect personnel training records. Accordingly, there is a need for a system and method for dynamically managing, in real-time, aircraft maintenance requirements.

BRIEF SUMMARY OF THE INVENTION

The present invention is a system for enabling an operator to dynamically manage maintenance of an aircraft. The system includes a program manager system, a tracking manager system and a production manager system. The program manager system is for extracting maintenance tasks from aircraft maintenance publications,

and for guiding the formation of maintenance tasks groups. The tracking manager system is for monitoring accumulated usage data of the aircraft, and for identifying maintenance due tasks and maintenance due task groups from the respective maintenance tasks and maintenance task groups for which a difference between the control point and the accumulated usage data is less than a user-defined critical value. The production manager system is for generating and implementing a dynamic maintenance flow chart which details scheduling data for each individual task of the maintenance due tasks and maintenance due task groups.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified block diagram of a system in accord with the present invention for dynamically managing, in real-time, aircraft maintenance requirements.

FIG. 2 is a flow diagram of an MRB program manager component of the system of FIG. 1.

FIGS. 3-4 illustrate example graphical user interfaces (GUI) used in conjunction with the MRB program manager component of the system of FIG. 1.

FIG. 5 is a flow diagram of a tracking manager component of the system of FIG. 1.

FIGS. 6-7 illustrate example graphical user interfaces (GUIs) used in conjunction with the tracking manager component of the system of FIG. 1.

FIG. 8 is a flow diagram illustrating a preferred method of using a DAMP manager component of the system of FIG. 1 to complete a maintenance check of an aircraft.

FIGS. 9-17 illustrate example graphical user interfaces (GUIs) used in conjunction with the DAMP manager component of the system of FIG. 1.

FIG. 18 is a flow diagram of an automatic task assignment component of the DAMP manager component of the system of FIG. 1.

DETAILED DESCRIPTION

FIG. 1 is a simplified block diagram of system 10 in accord with the present invention for dynamically managing, in real-time, aircraft maintenance requirements. System 10 interfaces with a plurality of aircraft, such as aircraft 12, corresponding aircraft maintenance requirements, such as aircraft maintenance requirements 14, personnel training records 16, FAA training requirements 18, and user preferences 20. System 10 is a multiple component system which includes Maintenance Review Board (MRB) program manager 22, aircraft tracking manager 24, Dynamic Aircraft Maintenance Production (DAMP) manager 26, reliability manager 28, electronic publications manager 30 and personnel training manager 32.

From aircraft maintenance requirements 14, MRB program manager 22 extracts maintenance tasks required for aircraft 12 and, for each task, time control points (or limits by which the task must be performed). MRB program manager uses this information to allow an airline operator to organize these tasks into logical groups which can be simultaneously performed. MRB program manager 22 provides the maintenance plan, along with the corresponding time control points, to aircraft tracking manager 24.

Tracking manager 24 monitors accumulated time data, such as flight hours and cycles), and compares this data to the data received from MRB program manager, to report on which tasks are approaching their time control point. Tracking manager 24 may also be used by an airline operator to schedule tasks during maintenance visits managed by DAMP manager 26.

When aircraft 12 enters a heavy maintenance period, DAMP manager 26 allows airline operators to create a dynamic maintenance program for assigning and monitoring the completion of tasks on aircraft 12.

Upon completion of a heavy maintenance period, reliability manager 28 records data relating to reliability of individual aircraft parts.

The airline's reliability board may later use reliability manager 28 to query the reliability data and generate reports useful for recommending changes to the MRB program.

Electronic publications manager 30 is a tool which gathers the multitude of publications needed in the aircraft maintenance industry, and provides them in an on-line environment.

Personnel training manager 32 provides tools for an airline operator to assign instructors, students, classrooms and audio visual equipment to specific training courses. Personnel training manager 32 further provides access from DAMP manager 26 to personnel training records 16 to enable an airline to know exactly when and what training its employees need.

Although it is preferable that an airline maintenance program utilize each of the components included in system 10 of FIG. 1, those skilled in the art will recognize that each of the individual components may be used independently, collectively, or in combinations of the components. Thus, an airline may incorporate only MRB program manager 22 and DAMP manager 26 with its own existing legacy system for monitoring when tasks are due on an aircraft.

System Inputs

Aircraft maintenance requirements 14, which originate from the aircraft manufacturer, list the tasks that must be accomplished on aircraft 12 and the timescale for how often the tasks must be accomplished in order to keep aircraft 12 in airworthy condition. The Maintenance Review Board (MRB) collects this information. These requirements can be revised throughout the life of aircraft 12 by any of the aircraft manufacturer, the Federal Aviation Administration (FAA), the Maintenance Review Board (MRB) or the airline operator (with FAA approval). Aircraft maintenance requirements 14 may include information regarding routine tasks, customer-specific tasks, FAA Airworthiness Directives, Manufacturer's Service Bulletins and Letters, and other trackable tasks required for airline maintenance.

Personnel training records 16 include data regarding the types of training each maintenance employee has received, and when that training was administered. FAA training requirements 18 document the training required of a maintenance employee before that employee can perform specified maintenance tasks.

MRB Program Manager

MRB program manager 22 takes aircraft maintenance requirements 14 and creates a maintenance program for aircraft 12. MRB program manager 22 allows an airline operator to organize all of the maintenance tasks into logical groups based on frequency, type, and an airline's operational/scheduling preferences 20. As a result, MRB program manager 22 provides a customized maintenance schedule that allows the airline to not only keep track of each maintenance task individually, but also carry out the maintenance tasks much more efficiently.

FIG. 2 is a flow diagram 40 of MRB program manager 22 of system 10 of FIG. 1. During its initial setup, which is step 42, MRB program manager 22 extracts from aircraft maintenance requirements 14, all of the tasks that must be performed on an aircraft of type aircraft 12, as well as the time control points (or limits by which the task must be performed) for each task.

At step 44, an airline operator will select whether logic formula MSG-2 (Maintenance Steering Group) or logic formula MSG-3 MRB will be used to organize tasks. With logic formula MSG-2, parts are changed at standard times regardless of whether the part actually needs to be changed. Thus, under MSG-2 logic, a part is always replaced at or before its normal life expectancy. Conversely, under logic formula MSG-3, parts are not replaced until broken. MSG-3 logic allows the MRB document to be revised based upon reliability data for the part during its life cycle. Thus, the types of tasks assigned under MSG-2 logic varies from the types of tasks assigned in MSG-3 logic; that is, more inspection tasks will be performed under MSG-3 logic than under

MSG-2 logic, while more part replacement tasks will be performed under MSG-2 logic than under MSG-3 logic.

At step 46, the extracted tasks are organized into letter checks, flight cycle checks (those tasks scheduled by flight cycles), separately tracked tasks and special tasks.

Depending on individual requirements, at step 48, airline management may modify, at any time, the initial grouping of tasks, as long as none of the time control points, or limits by which a task must be performed, is exceeded by the modified plan.

MRB program manager 22 preferably provides both the master maintenance program and the airline-modified maintenance program, along with the corresponding time control points, to aircraft tracking manager 24.

FIG. 3 illustrates example graphical user interface (GUI) 50 used in conjunction with MRB program manager 22 of system 10. In the example of FIG. 3, the tasks of a test aircraft are organized into a plurality of checks including A checks 52. Other types of checks not illustrated in FIG. 3 are C checks, eight-year checks, flight cycle checks, and special checks. In GUI 50, column 54 lists the name of each check. Column 56 details the number of tasks included within each of the plurality of checks. Column 58 details the forecasted hours required to complete each task. Column 60 lists the form number of each task. Columns 62 list the time control points (or interval periods at which each of the plurality of checks is to be performed). The time control point may be listed as a specific number of flight hours, flight cycles or months. For each of the plurality of checks, buttons are provided to allow an airline operator to revise the checks ("Revise" button in column 64), view the tasks within the check ("View" button in column 66), or generate a checklist of the tasks within the check ("Checklist" button in column 68).

FIG. 4 illustrates example graphical user interface (GUI) 80 used in conjunction with MRB program manager 22 of system 10. GUI 80 illustrates a partial listing of tasks 82 to be performed in

conjunction with a selected one of A checks 52 of FIG. 3. Tasks 82 within selected A check 52 are organized by region of the aircraft, such as "upper fuselage above cabin floor" and "tailcone & empennage group". For each task 82 listed in GUI 80, column 84 provides a task number, column 86 provides a task description, column 88 provides the task's official MRB interval (or time control point), column 90 provides an approximation of the amount of time required to perform the task, column 92 provides the task type, and column 94 provides the zone in which the work is to be performed. Details of each task 82 can be revised by selecting the corresponding "Revise" button provided in column 96.

In a preferred embodiment, MRB program manager 22 will include data converters to convert information stored in an airline's legacy system into a format usable by MRB program manager 22.

Aircraft Tracking Manager

Aircraft tracking manager 24 functions as an aircraft scheduling tool by keeping track of all maintenance activities accomplished on aircraft 12. Tracking manager 24 receives a maintenance program as an input from MRB program manager 22, tracks the amount of accumulated time for each maintenance task, and outputs tracking information in the form of a status report. If tracking manager 24 is used independently, the maintenance program is input from aircraft maintenance requirements 14.

FIG. 5 is a flow diagram 100 of tracking manager 24 of system 10. At step 102, tracking manager 24 receives the maintenance program. Preferably, MRB program manager 22 provides the master maintenance program, the airline-modified maintenance program, and corresponding time control points to aircraft tracking manager 24.

At step 104, non-routine tasks are added to the maintenance program, thereby allow both routine and non-routine tasks to be tracked. When a non-routine task is generated, it is linked to a particular routine task (the performance of which resulted in the

non-routine task). Reliability manager 28 may then use that relationship to determine whether a maintenance interval for a part can be escalated, or if it needs to be de-escalated.

At step 106, tracking manager 24 keeps track of information such as how many flight cycles, flight hours and time aircraft 12 has accumulated. When integrated with MRB program manager 22, tracking manager 24 ensures that aircraft 12 is not flown through one of its maintenance limits. Tracking data may be automatically entered into tracking manager 24 by an automated system installed aboard aircraft 12 or manually by airline ground crews. Manually-entered data may be entered at the end of a day by maintenance crews performing the aircraft's daily line check. Tracking data may also be provided by dispatch employees who also monitor this information.

At step 108, tracking manager 24 receives and logs all maintenance activities accomplished on aircraft 12, thereby serving as a maintenance logbook for aircraft 12. In this capacity, tracking manager 24 stores such information about each discrete task accomplished on aircraft 12 as what was done, what was replaced, who did the work and when was the work done. To meet FAA requirements, the electronic logbook may be printed and stored in paper format. When, if ever, the FAA approves the electronic storage of aircraft maintenance logbooks, airlines will no longer need to store paper copies of its maintenance records.

At step 110, tracking manager 24 compares, for each task, the accumulated time data to the task due data to determine which tasks will soon require maintenance, and at step 112, tracking manager 24 reports these results. By tracking each task as both an individual task and as a part of a task group (or check), the airline may move tasks into different groups without the danger of exceeding the task limitations.

Various status reports can be generated by users of tracking manager 24 by making inquires as to what tasks need to be completed within selected parameters. FIG. 6 illustrates example

graphical user interface (GUI) 120 used in conjunction with tracking manager 24. The example of FIG. 6 is a partial status report for test aircraft 12. The status report lists a plurality of tasks 122, and includes information on each task, such as, the MRB document source numbers listed in column 124 and a task description listed in column 126. Column 128 details the flight hour, flight cycle and date at which task 122 was last completed. Column 130 lists the flight hour, flight cycle or date by which task 122 must be performed. Finally, column 132 provides a "Revise" button allowing an airline operator to revise the specifications of a particular task.

FIG. 7 illustrates example graphical user interface (GUI) 140 used in conjunction with tracking manager 24. GUI 140 is an example "Tasks Due" screen 140 of system 10. Screen 140 shows, in real-time, a list of tasks due within a user-specified range of dates, hours, or cycles. The user can enter a number of hours 142, a number of cycles 144, or a date 146, and click on button 148 ("Retrieve Records") to retrieve a list of tasks due within the entered range. The resulting screen lists the task descriptions 150, the date last completed 152 (as well as the flight hours and flight cycles accrued by that completion date), the time limits 154 (or time control point), and the time remaining 156 for each task. The time remaining column will preferably provide a graphical cue to the user as to which tasks are overdue, which are nearing their due date, and which are not yet due. Such a graphical cue could be color-coding the remaining time information. In the example of FIG. 7, cells could be colored red to signify overdue tasks (not shown), cells 158 could be colored yellow to signify task which will be due within the user-specified range, and cells 159 could be colored white to signify tasks which are not yet due and outside the user-specified range. As the tasks are completed, the historical record for each task is updated in real-time to the current status. Screen 140 assists the user in developing the best plan and work order for an aircraft to insure that tasks are completed in a timely manner.

Tracking manager 24 may also be used by an airline operator to schedule tasks during maintenance visits managed by DAMP manager 26.

Dynamic Aircraft Maintenance Production (DAMP) Manager

DAMP manager 26 creates a dynamic maintenance program for assigning and monitoring the completion of tasks on aircraft 12 in a heavy maintenance environment. DAMP manager 26 is designed for multiple users of a production coordination system. Briefly, DAMP manager 26 is a system which allows maintenance employees to quickly, and easily, know what routine and non-routine tasks they are scheduled to complete; provides mechanic crew leads the ability to dynamically assign tasks to mechanics and to query which tasks are currently assigned and to whom they are assigned; and provides maintenance employees and supervisors the ability to compare actual time expended to complete a maintenance check to forecasted time for the maintenance check.

In the heavy maintenance environment, each individual maintenance team member, from mechanic to top-tier management, has a specific job to complete. An ideal maintenance plan for an aircraft would take into account the knowledge and experience of all employees working to maintain the aircraft. DAMP manager 26, in a sense, allows each employee to contribute to the overall maintenance production plan. In the DAMP system, each employee is given the tools they need to do their job. Each employee has access to computer screens containing information relevant to the completion of their own job. In using the system, each employee enters information into the system in response to the computer screens presented to the employee. That information is processed by DAMP manager 26, with the end result being that the mechanics always know exactly what tasks on which to work. Additionally, DAMP manager 26 creates a history of events to enable production coordinators to identify what works and what does not work in the maintenance plan.

FIG. 8 is a flow diagram 160 illustrating a preferred method of using DAMP manager 26 to complete a heavy maintenance check of aircraft 10. Initially, at step 162, DAMP manager 26 extracts data from MRB program manager 22 and tracking manager 24 to identify the routine tasks that need to be performed on aircraft 10. If DAMP manager 26 were operated in a stand-alone environment, this data would be retrieved directly from aircraft maintenance requirements 14, which would be abstracted by the airline operator.

At step 164, DAMP manager 26 preferably sorts the tasks into aircraft zones in which those tasks pertain, such as nose, tail or west wing.

At step 166, DAMP manager 26 generates a proposed flow for the aircraft. This flow may further be broken down by zone. In creating a proposed flow, DAMP manager 26 considers whether the completion of certain tasks is essential for the completion others.

At step 168, the production planner (the personnel member in charge of monitoring production flow) can modify the flow proposed by DAMP manager 26 based upon the availability of parts and employees, as well as the existence of non-routine tasks. Typically, the production planner knows the status of the shop and its available parts. For instance, if the planner knows that tires will not be available during the first week of maintenance, the planner can modify the flow to ensure that tasks relating to tire replacement do not occur during the first week. The planner may also add any known non-routine tasks to the flow.

Tasks are assigned to mechanics at step 170 in either a semiautomatic or automatic mode. If the semiautomatic mode is selected, tasks will be automatically be pulled from the flow diagram for a crew lead to assign to his crew. In this mode, the crew lead starts each shift by entering into DAMP manager 26 which employees are available. In response, DAMP manager 26 will generate a flow diagram for a user-selected number of shifts which includes tasks with forecasted completion times roughly matching the available manpower. The crew

lead can then distribute those generated tasks to the mechanics in his crew. In the automatic mode, tasks are automatically assigned at the start of each shift by DAMP manager 26. This automatic mode is discussed later in this specification.

At step 172, mechanics sign into DAMP manager 26 to retrieve their task cards. When the mechanic signs in and accepts a first task, the clock starts running on the first task, and when the employee signs onto a second task, the clock stops running on the first task. DAMP manager 26 uses this information to monitor the amount of time spent completing each task. Later, the actual times can be compared to the forecasted times to determine if the maintenance program is on schedule. This information can also be accumulated over a number of checks, and used by crew leads to determine which employees are most efficient at each task.

When signing out of the DAMP manager 26 at the end of a shift, at step 174, the mechanics and/or crew lead estimate the amount of time remaining on any incomplete tasks.

Also when signing out of DAMP manager 26, at step 176, mechanics enter any passdown notes or corrective actions taken during the performance of a task. Often, tasks left incomplete at the end of a shift are picked up by a mechanic on the next shift. Passdown notes enable those mechanics who continue working on the task to know what was completed by the previous mechanic. These notes do not remain part of the maintenance records, and are discarded once the task has been completed. Corrective action notes indicate what corrective actions were taken by a mechanic, and become part of the official maintenance logbook for the aircraft.

At step 178, inspectors review the work performed by mechanics. If the work is acceptable, the task card is signed off by the inspector. If the work is unacceptable, the task remains in the production schedule to be reassigned. DAMP manager 26 also monitors the work of the inspectors. Thus, as with the tasks performed

by mechanics, DAMP manager 26 monitors the amount of time the inspectors take to complete each inspection.

Often, while performing a routine task, the mechanics and inspectors will identify additional tasks that need to be accomplished to maintain the aircraft in an airworthy condition. At step 180, these non-routine tasks are entered into DAMP manager 26.

DAMP manager 26 constantly updates the overall completion time and tracks critical path jobs which will prevent subsequent jobs from being done. Thus, steps 164-180 are repeated until the maintenance check on the aircraft is complete.

An example implementation of DAMP manager 26 is illustrated in Figures 9-17. FIG. 9 illustrates example graphical user interface (GUI) 190 used in conjunction with DAMP manager 26. GUI 190 is an example status screen of system 10. Screen 190 shows in real-time the current maintenance status of aircraft 12. Section 192 of GUI 190 displays the tail number of aircraft 12 (US248 in this example) and user name (Melling). Section 192 also includes pull-down menus 194. Each pull-down menu 194 provides additional levels of access in DAMP manager 26. Thus, a crew member would be provided with only one pull-down menu, while senior management would be provided with several pull-down menus. In this example, user Melling is provided with five pull-down menus. In addition, section 192 includes button 196 ("Log Off") which allows the user to log off of DAMP manager 26.

Section 198 of GUI 190 is a line chart indicative of overall maintenance program progress with hours plotted vertically and days progressing horizontally. Time scale 200, which runs horizontally across section 198, chronologically displays the number of days in the check. Solid horizontal line 202, which is located immediately below time scale 200, represents the currently estimated number of hours required to complete the aircraft maintenance check. Estimate 204, which is displayed beneath solid horizontal line 202, provides a numeric representation of the total number of hours currently estimated to

complete the check. Solid horizontal line 206 represents the projected number of hours required to complete the aircraft maintenance check, while forecast 208, which is displayed beneath solid horizontal line 204, provides a numeric representation of the total number of hours projected to complete the check. First broken line 210 represents the planned available labor for the check (as it accrues each day), while second broken line 212 represents the actual labor expended each day on the check. Lines 210 and 212 can be color coded to allow easy differentiation by the airline operator.

The planned day of completion is represented by the intersection of first broken line 210 with solid horizontal line 202. Similarly, the actual day of completion is represented by the intersection of second broken line 212 with solid horizontal line 202. Vertical lines 214 represent milestones in the check. Count 216 indicates the current day of the check, as well as the total number of days planned to complete the check.

Section 218 of GUI 190 (entitled, "Check Status") illustrates, in real-time, the number of work cards ("Count"), the estimated number of hours required ("Estimated Hours"), the actual number of hours applied ("Actual Hours"), and the percentage complete ("% Complete") for various collections of tasks. In the example of GUI 190, tasks are organized by open tasks ("Open"), close tasks ("Close"), and non-estimated tasks ("Non-Estimated"), as well as totals for all tasks ("Total").

Section 220 of GUI 190 is a bar graph indicative of the real-time progress in individual cells (or zones) of aircraft 12. For each cell, the bars graphically illustrates the forecast of when the maintenance check of aircraft 12 will be complete. For example, in cell 1 (the wings zone), bar 222 indicates the number of labor hours that have been applied against that cell, the total bar (formed of bar 222 and bar 224) indicates the total number of hours that have been estimated in that cell, and the number following the total bar indicates the

percentage complete of that zone (27% in this example). Similar section 226 (not fully shown) displays a bar graph indicative of the real-time progress by skill type and the total number of mechanics available by skill.

FIG. 10 illustrates example graphical user interface (GUI) 230 used in conjunction with DAMP manager 26 of system 10. GUI 230 includes a dynamic GANTT chart 232 (hereinafter referred to as flow chart 232) indicating the proposed maintenance check flow. Flow chart 232 is designed to pull together all available resources to graphically deliver a dynamic indication of how the check is to proceed if the maintenance plan relating to such variables as task priorities, crew assignments, mechanic availability, task dependancies and task delay is followed. Flow chart 232 is constantly updated to always reflect the most current data.

As in FIG. 9, section 234 of GUI 230 displays the tail number of aircraft 12 (US248)and user name (Melling). Section 234 also includes pull-down menus 236. In addition, section 234 includes button 238 ("Log Off") which allows the user to log off of DAMP manager 26.

Flow chart 232 shows, in real-time, a list of all tasks that are required to be completed during the maintenance check of aircraft 12. Time scale 240 chronologically displays the number of days in the check. In flow chart 232, a width of task bar 242 indicates the time duration of a specific task, while the location of task bar 242 indicates its placement in the overall schedule. As flow chart 232 is dynamically updated, completed tasks will be represented by their actual duration and placement, while incomplete tasks will be represented by their planned duration and placement.

Vertical lines 244 in flow chart 232 represent milestones in the production plan. These milestones are determined by airline management to represent their goals. Vertical lines 244 provide a graphical representation of where the production is in relationship to the

milestones. These milestones can also be included in section 198 of GUI 190.

Flow chart 232 can be color-coded to provided a visual cue as to which tasks will fall behind schedule if the current maintenance plan is followed. For instance, completed tasks, tasks presently being worked on, tasks having a scheduled start time that has already elapsed, and future tasks could each be displayed in different colors to allow the airline operator to reallocate resources to get back on track. Flow chart 232 also allows the airline operator to reorder tasks, assign crews, assign dependencies to tasks, and make other decisions in order to avoid missing the check completion date.

FIG. 11a illustrates example graphical user interface (GUI) 250 used in conjunction with DAMP manager 26. GUI 250 is an example crew assignment screen listing tasks assigned to a specific crew working on aircraft 12. Again, section 252 displays information about aircraft 12 and the user, as well as pull-down menus and a log off button. In this example, user "Roche" has access to only two pull-down menus (compared with five in FIG. 9), indicating that user "Roche" has less access to DAMP manager 26 than user "Melling" of FIG. 9.

In GUI 250, tasks are organized according to status. For instance, tasks could be ordered such that top-most tasks have the highest priority, followed sequentially by tasks on hold and non-scheduled tasks. To convey a visual cue as to the urgency of each task, title bar 254 can be colored to indicate the status of the task. Such a visual cue allows the crew lead to better decide how tasks should be assigned.

Title bar 254 details the task identification number, the task description, and other information pertinent to the task. For each task, required skill level 256 ("Mechanic 1" for the first-listed task) is displayed.

To assign a crew member to a task, the user simply checks box 258 under the name of the crew member to whom the task

is assigned. Once the task is assigned, the crew member may sign onto the task, at which time the clock starts running on that crew member to collect the total amount of time spent on that task. If a crew member has not logged into DAMP manager 26, a visual cue 260, such as a red square drawn around his corresponding check box 258, may be displayed to instantly alert the user of which employees are absent, whereas a green box could be used to indicate that a crew member is awaiting task assignment. A similar visual cue could be provided if the crew member is in training. This visual signal is helpful because tasks cannot be assigned to crew member who are absent or in training.

In GUI 250, the user can select button 262 ("Work Card") to access a particular task's printable work card for distribution to the crew members. Alternatively, crew members can print their own work cards when checking into DAMP manager 26 to see what tasks have been assigned to them (preferably presented in sequential order of how they should be completed). Not shown in FIG. 11a, GUI 250 can also provide a revise button to allow the user to access a task revision screen for a particular task.

FIG. 11b illustrates example graphical user interface (GUI) 270 used in conjunction with DAMP manager 26 of system 10. GUI 270 is an example crew member assignment screen listing tasks currently assigned to a specific crew member working on aircraft 12. Again, section 272 displays information about aircraft 12 and the user, as well as pull-down menus and a log off button. In this example, user "Albin" (crew member from FIG. 11a) has access to two pull-down menus.

In GUI 270, tasks are organized according to log in status. For instance, tasks could be color-coded such that tasks that the crew member is currently logged in to work on are colored in gray, followed by tasks that the crew member is not currently logged in to work on which are colored in white.

Title line 274 details the task identification number, the task description, and other information pertinent to the task. For each

task, the names of the crew members assigned to the task 276 are displayed. The crew member can select button 278 ("Work Card") to access a particular task's printable work card.

FIG. 12 illustrates example graphical user interface (GUI) 280 used in conjunction with DAMP manager 26 of system 10. GUI 280 is an example work card screen which shows, in real-time, the current status of a selected task. GUI 280 can be accessed in several ways, one of which is the selection of work card button 262 of GUI 250.

GUI 280 presents the following information about the selected task: aircraft tail number 282, task number 284, bar code 286 corresponding to task number 284, work order number 288, zone number 290, sequence number 292, estimated hours 294, actual hours accrued 296, suggested number of crew members 298, skill required 300, crew numbers 302 of crews assigned to task, current date 304, station number 306, and discrepancy or task description 308.

GUI 280 also provides box 310 to enable the assigned mechanic to record evaluation notes, box 312 to enable assigned mechanic to record repair reference, box 314 to enable the assigned mechanic to record work-in-progress notes, and box 316 to enable the assigned mechanic to record notes regarding repair, corrective action, turnover, or rejection. Not shown in FIG.12, GUI 280 also provides a box to enable the assigned mechanic to sign off on the task, a box to indicate that the task is ready for inspection, and a box to enable the assigned inspector to completely sign off on the task.

To generate a task card, which lists instructions for how a task is to be completed, the user selects a task card button (which is not shown in FIG. 12).

FIG. 13 illustrates example graphical user interface (GUI) 320 used in conjunction with DAMP manager 26 of system 10. GUI 320 is an example task card screen which provides instructions for how a selected task is to be performed. GUI 320 can be accessed in several

ways, one of which is the selection of a task card button (which is not shown) of GUI 280.

GUI 320 presents the following information about a selected task: task card number 322, work order number 324, aircraft tail number 326, aircraft serial number 328, accrued flight hours 330, accrued cycles 332, and date 334. GUI 320 also presents a series of steps 336 which provide instructions on how the task is to be performed. In the example illustrated, there are two steps (A and B), with step B having two sub-steps (1 and 2). Columns 338 and 339 indicate what skill types should perform each step. GUI 320 is configured according to the standards of the airline operator for which DAMP manager 26 is designed.

FIG. 14 illustrates example graphical user interface (GUI) 340 used in conjunction with DAMP manager 26 of system 10. GUI 340 is an example task revision screen used to revise information about a specific task. GUI 340 can be accessed in several ways, one of which is the selection of a revise button on GUI 250 (not shown in FIG. 11a).

GUI 340 includes the following real-time information, all of which can be edited in GUI 340: task description 342, number of crew members required 344, estimated time 346, actual time accrued 348, target day for accomplishment 350, delay amount 352, estimated start day 354, assigned crew number 356, milestone the task must precede 358, milestone the task must follow 360, task dependency 362, task card number364, sequence number 366, and zone number 368.

GUI 340 may be accessed for several reasons. Management may want to revise the number of resources (i.e., number of crew members required 344 and estimated time 346) assigned to a task, or some complication which delays completion of the task. If a task need be delayed, the user can select the number of days the task should be delayed, along a reason for the delay. A user selects button 370 ("Revise") to indicate that the task revision form has been completed, and to enter the new information into the system 10. Button

372 ("Work Card") allows the user to access the work card screen for the task. Button 374 ("Exit") allows the user to exit GUI 340.

Section 376 of GUI 340 visually indicates (preferably by a color-coded dot 378 or an arrow) the location on aircraft 12 where the selected task is targeted. Photograph 384 of the task location is also provided. GUI 340 also indicates, in real-time, where this task falls in the overall production plan. Combined, bar graph 380 and indicator mark 382 represent the current priority of the selected task in relation to all the other maintenance tasks within the check. The priority of the task can be increased by sliding indicator mark 382 toward the top of bar graph 380. Conversely, the priority of the task can be decreased by sliding indicator mark 382 toward the bottom of bar graph 380. A similar bar graph and indicator mark can also be provided to indicate where in the current overall status of the maintenance check the task lies.

FIG. 15 illustrates example graphical user interface (GUI) 390 used in conjunction with DAMP manager 26 of system 10. GUI 390 is an example work locations screen of system 10. GUI 390 presents a graphical image of aircraft 12 (from three different perspectives) and dots to identify where on aircraft 12 maintenance needs to be performed. As a user moves the cursor over selected dot 392, a roll-over description of the maintenance task can be provided. The user can click on dot 392 to access the work card screen for that particular maintenance task.

FIG. 16 illustrates example graphical user interface (GUI) 400 used in conjunction with DAMP manager 26 of system 10. GUI 400 is an example work card screen for a non-routine task. GUI 400 is essentially identical to GUI 280 (work card screen for a routine task), except that GUI 400 includes photograph 402 of reported discrepancy 404.

FIG. 17 illustrates example graphical user interface (GUI) 410 used in conjunction with DAMP manager 26 of system 10. GUI 410 is an example "Task Re-Evaluation" shift end screen. Section 412

displays information about aircraft 12 and the user, as well as pull-down menus and a log off button.

Section 414 of GUI 410 lists all tasks having more hours applied to them than last estimated. Column 416 lists the task number and description of each task, column418 lists the estimated number of hours to complete that task, column 420 lists the actual hours accrued (so far) to that task, column 422 provides a box in which the crew lead can supply a new estimate of the time remaining on that task, and column 424 provides the crew numbers of crews assigned to that task.

Section 426 of GUI 410 provides a tool to log crew members out of DAMP manager 26. To log a specific crew member off, the user need only check box 428 located beneath the crew member's name, and then select button 430 ("Sign Out").

Reliability Manager

Upon completion of a heavy maintenance period, reliability manager 28 records data relating to reliability of individual aircraft parts. The airline's reliability board may later use reliability manager 28 to query the reliability data and generate reports useful for recommending changes to the MRB program.

Reliability manager collects information about non-routine tasks. Tracking manager 24 links each non-routine task to its generating routine task to allow reliability manager 28 to determine whether a maintenance interval for a part can be accelerated, or if it needs to be decelerated.

Reliability manager 28 also collects all the information regarding rotable parts (those parts which can be repaired) including when they were installed, when they were removed, what were the non-routine tasks performed in their life cycle, when they came in for line maintenance checks and their parent-child relationship with other rotable parts. Reliability manager 28 allows airlines to evaluate whether or not a rotable part is actually meeting the manufacturer's predicted life limits. In addition, reliability manager 28 analyzes the maintenance

program produced by MRB program manager 22 and the maintenance logbook produced by tracking manager 24 to analyze the reliability of each rotable part. If a rotable part never has a deficiency within the suggested inspection interval, the airline may modify its maintenance program based upon the reliability data produced by reliability manager 28.

The primary purpose of an MRB document is to assist the regulatory authorities in determining the initial scheduled maintenance requirements for new or derivative types of transport-category aircraft. The MRB document is used as the basis from which an airline develops its own continuous airworthiness maintenance program. Any change to the maintenance program requires an analysis phase and an appropriate sampling of aircraft reliability data. The resulting information serves as justification for any modifications to the airline's maintenance program.

A reliability program establishes the time limitations or standards for determining intervals between overhauls, inspections and checks of aircraft equipment. Guidance on reliability program elements is listed in Advisory Circular (AC) 120-17, Maintenance Program Management Through Reliability Methods, as amended, the Airline/Manufacturer Maintenance Program Planning Document, MSG-2/3, and/or Maintenance Tasks. A reliability program typically collects reliability data from sources including unscheduled removals of parts, confirmed failures of parts, pilot reports, sampling inspections, shop findings, functional checks, bench checks, service difficulty reports, mechanical interruption summaries and other sources the airline considers appropriate.

Electronic Publications Manager

Electronic publications manager 30 is a tool which gathers the multitude of publications needed in the aircraft maintenance industry, and provides them in an on-line environment.

The airline maintenance industry is a highly regulated industry which produces a substantial number of disparate publications essential for operation of an airline maintenance facility. Electronic publications manager 30 is a tool that gathers this multitude of publications into an electronic form, thus making the publications more easily accessible to aircraft maintenance personnel.

Electronic publications manager 30 works cooperatively with MRB program manager 22, tracking manager 24 and DAMP manager 26 to provide access to needed documents as needed by maintenance personnel.

Electronic publications manager 30 stores such publications as training manuals, maintenance manuals, illustrated parts catalogs, structural repair manuals, aircraft wiring diagram manuals, FAA directives and an airline's specific general engineering and maintenance manual.

Electronic publications manager 30 can work with the other components of system 10 to instantly link each task in the maintenance program to work cards, which explain an airline's preferred method of performing that task, or may include photographs or wiring diagrams helpful to performing the task.

Personnel Training Manager

Personnel training manager 32 provides tools for an airline operator to assign instructors, students, classrooms and audio visual equipment to specific training courses. Personnel training manager 32 further provides access from DAMP manager 26 to personnel training records 16 to enable an airline to know exactly when and what training its employees need.

Personnel training manager 32 provides tools for an airline to assign instructors, students, classrooms and audio visual equipment to specific courses. Personnel training manager 32 further provides access to personnel training records 16 to enable an airline to know exactly when and what training its employees need.

Personnel training manager 32 allows an airline to organize personnel training records 16 in a variety of formats, including lists of those individuals requiring recurrent training in a specific course, those individuals who are scheduled for training within a specified period of time, those individuals who require recurrent training in a specific course, those individuals who require recurrent training in all courses, those individuals who are scheduled for training within a specified time frame, those courses that are currently scheduled (along with corresponding instructors and trainees) and those classrooms that are available.

As training occurs, personnel training manager 32 supplements personnel training records 16 to incorporate information regarding training each employee receives, thereby keeping personnel records 16 up-to-date. Personnel training manager 32 keeps track of both classroom training and on-the-job training.

In addition, personnel training manager 32 compares personnel training records 16 with FAA training requirements 18 to monitor which tasks each employee is qualified to perform. By integrating personnel training manager 32 with DAMP manager 26, crew leads can quickly ascertain which mechanics have the training necessary to perform specific tasks, thereby ensuring that only qualified mechanics are assigned to tasks. The FAA has very strict standards regarding the training required of aircraft mechanics. Before a mechanic can independently perform a task, the FAA requires that the mechanic have either been previously supervised performing the task or been specifically trained for that task.

Another advantage of integrating personnel training manager 32 with DAMP manager 26, is that employees, as well as maintenance management, are instantly notified of the employee's training schedule.

Additionally, as employees are scheduled off the floor for training, DAMP manager 26 instantaneously makes adjustments to the

number of employee hours available to complete maintenance of an aircraft. Thus, the production coordinator can immediately ascertain the effect of removing those employees from the work floor, and will be able to plan the maintenance production accordingly. If the production schedule is negatively affected by the training (i.e., one or more days are added to the production schedule), the production planner may schedule some personnel to work overtime or shift personnel in from other maintenance bays to make up the missing production hours. A production coordinator may also consult with training personnel to reschedule the training to minimize harm to the production schedule (e.g., perhaps only six of twelve employees scheduled for training will actually attend the training). Effectively, the management team is given early options to control its production schedule.

Automatic Assignment of Employees

As mentioned in reference to step 170 of FIG. 8, DAMP manager 26 can integrate with personnel training manager 32 to automatically assign employees to tasks. DAMP manager 26 prioritizes the tasks within the maintenance program, analyzes data regarding training of employees (gained from personnel training manager 32), and assigns the best mechanic to the job.

FIG. 18 is a flow diagram of the automatic task assignment component of DAMP manager 26. At step 332, the auto-assign system receives a prioritized list of tasks to be accomplished in one to two days, and at step 334, the auto-assign system receives personnel training data from personnel training manager 32. At step 336, the auto-assign system compares the available resources to the need resources to timely complete the maintenance check. If there is enough time and enough mechanics to enable the completion of all necessary tasks within the necessary time period, the auto-assign system will enter a training mode. In this training mode, at step 338, DAMP manager 26 will assign to specific tasks, when possible, those mechanics who need on the job training along with a mechanic who has the necessary

training. To enable this automatic training function, DAMP manager 26 analyzes the maintenance flow of the aircraft, how much maintenance time is remaining, how many tasks need to be accomplished, how many mechanics are scheduled to work and personnel training records 16.

DAMP manager 26 continues to monitor the maintenance flow during production. If maintenance flow falls behind schedule, the automatic assignment of tasks will switch from a training mode to a best skilled mode. In this mode, at step 340, each task is assigned the best skilled employee(s) to ensure the timely completion of the maintenance check. If the available resources become sufficient at anytime during the check, the auto-assign system can switch back to the training mode. Additionally, this automatic assignment of employees can be overwritten by crew leads or production management at any time.

Implementation

According to the present invention, a system and method are provided for dynamically managing, in real-time, aircraft maintenance requirements. The system and method of the present invention brings a distributed computing framework of using client/server and Internet technologies to the field of aircraft maintenance, allowing end-users to react quickly to the dynamics of everyday events. The system and method of the present invention take advantage of a process of using the Internet browser technology to deliver real-time distributed software products for the aircraft maintenance industry.

Applications

The airline industry is formed of four tiers of airline operators: the major airlines, the regional airlines, the corporate owners of small fleets of aircraft and the individual (or private) owners of aircraft. Each of these tiers of operators has need for some-scaled version of system 10 of the present invention. Certainly, an individual owner of a single aircraft will have different needs that a multiple-hubbed major aircraft operator of a large fleet of aircraft. Nonetheless, each of the

above-described components of system 10 has applicability to each tier of aircraft operators.

Application to Major Airlines

Major airlines typically operate a large and varying fleet of passenger aircraft. These operators generally fly into a large number of cities, with maintenance potentially occurring in any of those cities, and heavy maintenance bases in several of those cities. The major airlines stand to lose a substantial amount of revenue each day one of its aircraft is grounded due to maintenance. Therefore, one of the main priorities for the major airline is to minimize the number of days that its aircraft remain in heavy maintenance (without sacrificing the airworthiness of the aircraft) by efficiently managing the completion of tasks during heavy maintenance periods. For that reason, DAMP manager 26 is likely the most important component of a major airline's maintenance management program. Similarly, personnel training manager 32 aids the airline in ensuring that their maintenance personnel are training

Application to Regional Airlines

Regional airlines will typically operate a much smaller fleet of aircraft than the major airlines, with less variety in the type of aircraft. Additionally, the aircraft owned by the regional airlines tend to be smaller than those owned by the major airlines, and tend to require fewer maintenance tasks to keep them airworthy. Because of the smaller scale of the regional airlines, they do not have the same manpower and resources of the major airlines to create individualized maintenance programs. Thus, the regional airlines tend to be more concerned with simply gathering all of the information about their maintenance program in one place. For that reason, MRB program manager 22 and tracking manager 24 are likely the most important components of a regional airline's maintenance management program. MRB program manager 22 and tracking manager 24 will provide the regional airlines with the tools needed to organize their maintenance

tasks into logical groupings, and to monitor those tasks for when they are due.

At the regional airlines, reliability analysis also suffers due to the limited resources available to the regional airlines. A reliability program to monitor warranty issues and MRB document modifications is a particularly complicated (and expensive) program to implement. Such a program simply requires a large number of resources (typically personnel) to gather and analyze the large amount of data needed to (1) establish individual parts have met manufacturer's warranty, and (2) meet the FAA regulations for modifying one's MRB document. Thus, reliability manager 28 can be another key component to add to their maintenance management system.

Application to a General or Corporate Aviation Environment

Corporate and general aviation aircraft operators typically own one to five aircraft. Often, the aircraft owned by corporate and individual operators do not have MRB maintenance documents associated with them, but only a maintenance manual supplied by the aircraft manufacturer. In lieu of an MRB maintenance document, the tasks and suggested performance intervals listed in the maintenance manual can loaded into MRB program manager 22 to create a well-organized maintenance program, and into tracking manager 24 to track the tasks listed in the maintenance manual.

Summary

The system and method of the present invention is a software system designed for the multiple users of a production coordination system within the aircraft maintenance industry. It allows mechanics to understand exactly what routine and non-routine items they are to work on, it allows the crew leads to assign tasks to crew members and query as to what tasks are currently being worked on and by whom, and it provides the managers the opportunity to compare actual time expended on aircraft compared to forecasted time and to adjust crew priorities in real-time. Crew leads, managers and executive

management can quickly evaluate where the aircraft is in relation to the forecasted time of the aircraft check as to percentage complete and estimated time of completion visually by the use of easy-to-understand charts.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

CLAIMS:

1. A system for enabling an operator to dynamically manage maintenance of an aircraft, the system comprising:

a program manager system for extracting maintenance tasks from aircraft maintenance publications, and for guiding the formation of maintenance tasks groups;

a tracking manager system for monitoring accumulated usage data of the aircraft, and for identifying maintenance due tasks and maintenance due task groups from the respective maintenance tasks and maintenance task groups for which a difference between the control point and the accumulated usage data is less than a user-defined critical value; and

a production manager system for generating and implementing a dynamic maintenance flow chart which details scheduling data for each individual task of the maintenance due tasks and maintenance due task groups, the production manager system frequently updating the maintenance flow chart to reflect current system data.

2. The system of claim 1 wherein the program manager system comprises:

means for extracting maintenance tasks for the aircraft from at least one aircraft maintenance document, each maintenance task having a control point which specifies an interval at which the maintenance task is to be performed;

means for sorting the maintenance tasks into initial maintenance task groups having common control points; and

means for guiding the airline operator to organize the maintenance tasks and initial maintenance task groups into a plurality of maintenance task groups, each of the plurality of maintenance task groups having a user-assigned control point.

3. The system of claim 2 wherein the at least one aircraft maintenance document comprises a Maintenance Review Board document.

4. The system of claim 2 and further comprising:

means for alerting the airline operator of any tasks which have a control point less than the user-specified control point for the maintenance task group in which the task is grouped.

5. The system of claim 2 wherein the task accomplishment data includes a maintenance date on which the maintenance task was completed, as well as a number of flight hours and flight cycles accumulated on the aircraft by the maintenance date..

6. The system of claim 2 wherein the tracking manager system comprises:

means for tracking accumulated usage data of the aircraft;

means for receiving a list of routine tasks required to be performed on the aircraft, each routine task having a control point which defines an interval at which the routine task is to be performed;

means for tracking task accomplishment data for each routine task;

means for determining a maintenance due point for each routine task, the maintenance due point being

based upon the control point and the accomplishment data of the routine task;

means for identifying maintenance due tasks as those routine tasks for which a difference between the maintenance due point of the routine task and the accumulated usage data of the aircraft is less than a user-defined critical value; and

means for reporting maintenance due tasks.

7. The system of claim 6 wherein the accumulated usage data includes a number of accumulated flight hours and a number of accumulated flight cycles of the aircraft, as well as a current date.

8. The system of claim 6 wherein the list of routine tasks comprises maintenance tasks and maintenance task groups.

9. The system of claim 6 wherein task accomplishment data includes a maintenance date on which the routine task was completed, as well as a number of flight hours and flight cycles accumulated on the aircraft by the maintenance date.

10. The system of claim 6 and further comprising:

means for receiving a list of non-routine tasks required to be performed on the aircraft, each non-routine task having a maintenance due point by which the non-routine task must be performed;

means for identifying non-routine maintenance due tasks as those non-routine tasks for which a difference between the maintenance due point of the non-routine task and the accumulated usage data of the aircraft is less than a user-defined critical value; and

means for reporting non-routine maintenance due tasks.

11. The system of claim 1 wherein the production manager system comprises:

means for obtaining any routine tasks that may exist, and which are required to be performed on the aircraft;

means for obtaining any non-routine tasks that may exist, and which are required to be performed on the aircraft;

means for generating a maintenance flow chart detailing scheduling data for each of the routine and non-routine tasks;

means for assigning a user-determined number of the routine and non-routine tasks to personnel for completion;

means obtaining for maintenance activity data on each assigned routine task and non-routine task;

means obtaining for available resource data; and

means for updating the maintenance flow chart to reflect newly-obtained maintenance activity data and available resource data.

12. The system of claim 11 wherein the obtained non-routine tasks result from the performance of routine tasks by inspection and maintenance personnel.

13. The system of claim 11 wherein the scheduling data comprises:

a project forecast of an amount of time required to complete the maintenance check;

a start time and an execution time for each of the obtained routine and non-routine tasks, wherein the start and execution times are estimated values for incomplete tasks and are actual values for completed tasks.

14. The system of claim 11 wherein the means for generating a maintenance flow chart comprises

means for identifying any dependent tasks that may exist, the dependent tasks being those routine and non-routine tasks which cannot be performed until the completion of at least one of the routine and non-routine tasks; and

means for generating a maintenance flow chart in which no dependent task has a start time earlier than an end time of any of the routine and non-routine tasks from which the dependent task depends.

15. The system of claim 11 wherein the means for generating a maintenance flow chart comprises:

means for generating a proposed maintenance flow chart;

means for obtaining planning personnel modifications to the proposed maintenance flow chart; and

means for generating a maintenance flow chart which incorporates the planning personnel modifications.

16. The system of claim 11 wherein the means for assigning a user-determined number of routine and non-routine tasks to personnel for completion comprises means for obtaining assignment information from maintenance personnel.

17. The system of claim 11 wherein the means for obtaining maintenance activity data on each assigned routine and non-routine task comprises means for obtaining a start time and an execution time for each assigned routine and non-routine task, the start time being a time at the task was assigned and the execution time being an elapsed amount of time spent completing the task.

18. The system of claim 11 wherein the means for obtaining maintenance activity data on each assigned routine and non-routine task comprises means for obtaining new estimated execution times for those incomplete routine and non-routine tasks for which an actual execution time exceeds an initially-estimated execution time.

19. The system of claim 11 wherein obtaining maintenance activity data on each assigned routine and non-routine task comprises means for obtaining pass-down notes from an assigned personnel member for those routine and non-routine tasks left incomplete by the assigned personnel member.

20. The system of claim 11 wherein the available resource data comprises labor hours available.

21. The system of claim 11 wherein maintenance flow chart is graphically represented via a GANTT chart.

22. The system of claim 1 and further comprising:

a reliability manager system for extracting and logging reliability data from maintenance records generated by the production manager system for both rotable parts of the aircraft and for each maintenance task.

23. The system of claim 22 wherein the reliability manager comprises:

means for obtaining and logging warranty-based reliability data from maintenance records generated during the performance of any routine or non-routine tasks that may exist, and which pertain to rotable parts of the aircraft;

means for obtaining and logging maintenance program-based reliability data from maintenance records generated during the performance of any non-routine tasks that may exist;

means for identifying for each non-routine task, a routine task whose performance resulted in the generation of the non-routine task;

means for obtaining and logging maintenance program-based reliability data from maintenance records

generated during the performance of any identified routine tasks that may exist; and

means for analyzing and reporting the warranty-based reliability data and the maintenance program-based reliability data.

24. The system of claim 23 wherein the warranty-based reliability data is reported for use in generating warranty reports for the rotable parts of the aircraft.

25. The system of claim 23 wherein the maintenance program-based reliability data is reported for use in generating reports on modifications to an Maintenance Review Board document.

26. The system of claim 1 and further comprising:

a personnel training manager system for enabling the production manager system to determine assignments of individual tasks to maintenance personnel based upon an analysis of the maintenance flow chart and personnel training records.

27. The system of claim 26 wherein personnel training manager system comprises:

means for obtaining a dynamic maintenance flow chart detailing up-to-date scheduling data for a predetermined number of maintenance tasks;

means for obtaining personnel training records for each crew member;

means for determining maintenance task assignments based upon an analysis of the maintenance flow chart and the personnel training records, each crew member being assigned at least one maintenance task.

28. The system of claim 27 wherein the means for determining maintenance task assignments comprises:

means for analyzing the personnel training records to identify maintenance tasks for which at least one crew member requires training and at least one crew member is trained; and

means for assigning the identified task to both the at least one crew member requiring training in the training task and the at least one crew member who is trained in the training task.

29. The system of claim 27 wherein the means for determining maintenance task assignments comprises:

means for prioritizing the maintenance tasks;

means for analyzing the personnel training records to identify crew members best skilled to perform each maintenance task;

means for assigning each maintenance tasks to crew members based upon an analysis of which crew members are best skilled at each maintenance task and the prioritization of each maintenance task.

30. The system of claim 27 wherein the means for determining maintenance task assignments based upon an analysis of the maintenance flow chart and the personnel training records comprises:

means for monitoring the dynamic maintenance flow chart to determine if the maintenance check is on schedule;

means for determining maintenance task assignments which facilitate training of crew members when the maintenance check is on schedule; and

means for determining maintenance task assignments which facilitate prompt completion of the maintenance check when the check is not on schedule.

31. The system of claim 1 and further comprising:

a personnel training manager system for analyzing personnel training records to determine which aircraft personnel require a specific training, and for scheduling training classes for those aircraft personnel in the required training.

32. The system of claim 1 and further comprising:

a publications manager for organizing and displaying information from a multitude of publications needed in the aircraft maintenance industry.

33. The system of claim 1 wherein the system is implemented over a communication medium operably connected to a plurality of input/output devices each having means for inputting and outputting information.

34. The system of claim 33 wherein the communication medium is the digital communication network.

35. A method for enabling an operator to dynamically manage maintenance of an aircraft, the method comprising:

extracting maintenance tasks from aircraft maintenance publications;

guiding the formation of maintenance tasks groups;

monitoring accumulated usage data of the aircraft;

identifying maintenance due tasks and maintenance due task groups from the respective maintenance tasks and maintenance task groups for which a difference between the control point and the accumulated usage data is less than a user-defined critical value;

generating and implementing a dynamic maintenance flow chart which details scheduling data for each individual task of the maintenance due tasks and maintenance due task groups; and

updating the maintenance flow chart to reflect current system data.

36. The method of claim 35 and further comprising:

extracting and logging reliability data from maintenance records generated during performance of individual tasks, the extracted and logged maintenance records pertaining to both rotable parts of the aircraft and to each maintenance task.

37. The method of claim 35 and further comprising:

determining assignments of individual tasks to maintenance personnel based upon an analysis of the maintenance flow chart and of personnel training records.

38. The method of claim 35 and further comprising:

analyzing personnel training records to determine which aircraft personnel require a specific training; and

scheduling training classes for those aircraft personnel in the required training.

39. The method of claim 35 and further comprising:

organizing and displaying information from a multitude of publications needed in the aircraft maintenance industry.

40. A system for enabling an operator to dynamically manage maintenance of an aircraft, the system comprising:

means for extracting maintenance tasks from aircraft maintenance publications;

means for guiding the formation of maintenance tasks groups;

means for monitoring accumulated usage data of the aircraft;

means for identifying maintenance due tasks and maintenance due task groups from the respective

maintenance tasks and maintenance task groups for which a difference between the control point and the accumulated usage data is less than a user-defined critical value;

means for generating and implementing a dynamic maintenance flow chart which details scheduling data for each individual task of the maintenance due tasks and maintenance due task groups; and

means for updating the maintenance flow chart to reflect current system data.

41. The system of claim 40 and further comprising:

means for extracting and logging reliability data from maintenance records generated during performance of individual tasks, the extracted and logged maintenance records pertaining to both rotable parts of the aircraft and to each maintenance task.

42. The system of claim 40 and further comprising:

means for determining assignments of individual tasks to maintenance personnel based upon an analysis of the maintenance flow chart and of personnel training records.

43. The system of claim 40 and further comprising:

analyzing personnel training records to determine which aircraft personnel require a specific training; and

scheduling training classes for those aircraft personnel in the required training.

44. The system of claim 40 and further comprising:

means for organizing and displaying information from a multitude of publications needed in the aircraft maintenance industry.

45. A method for managing an aircraft maintenance program for an aircraft operated by an operator, the method comprising:

extracting maintenance tasks for the aircraft from at least one aircraft maintenance document, each maintenance task having a control point which specifies an interval at which the maintenance task is to be performed;

sorting the maintenance tasks into initial maintenance task groups having common control points;

guiding the airline operator to organize the maintenance tasks and initial maintenance task groups into a plurality of maintenance task groups; and

guiding the airline operator in assigning user-specified control points for each of the plurality of maintenance task groups.

46. A system for managing an aircraft maintenance program for an aircraft operated by an operator, the system comprising:

means for extracting maintenance tasks for the aircraft from at least one aircraft maintenance document, each maintenance task having a control point which specifies an interval at which the maintenance task is to be performed;

means for sorting the maintenance tasks into initial maintenance task groups having common control points; and

means for guiding the airline operator to organize the maintenance tasks and initial maintenance task groups into a plurality of maintenance task groups, each of the plurality of maintenance task groups having a user-assigned control point.

47. A system for managing an aircraft maintenance program for a fleet of aircraft owned by an operator, the system comprising:

means for extracting maintenance tasks for each type of aircraft from at least one aircraft maintenance document, each maintenance task having a control point which specifies an interval at which the maintenance task is to be performed;

means for sorting, for each aircraft type, the maintenance tasks into initial maintenance task groups having common control points; and

means for guiding the airline operator to organize, for each aircraft type, the maintenance tasks and initial maintenance task groups into a plurality of maintenance task groups, each of the plurality of maintenance task groups having a user-assigned control point.

48. An aircraft maintenance tracking system for tracking aircraft maintenance required on an aircraft, the aircraft maintenance tracking system comprising:

means for tracking accumulated usage data of the aircraft;

means for receiving a list of routine tasks required to be performed on the aircraft, each routine task having a control point which defines an interval at which the routine task is to be performed;

means for tracking task accomplishment data for each routine task;

means for determining a maintenance due point for each routine task, the maintenance due point being based upon the control point and the accomplishment data of the routine task;

means for identifying maintenance due tasks as those routine tasks for which a difference between the maintenance due point of the routine task and the

accumulated usage data of the aircraft is less than a user-defined critical value; and

means for reporting maintenance due tasks.

49. A method for tracking aircraft maintenance required on an aircraft, the method comprising:

tracking accumulated usage data of the aircraft;

receiving a list of routine tasks required to be performed on the aircraft, each routine task having a control point which defines an interval at which the routine task is to be performed;

tracking task accomplishment data for each routine task;

determining a maintenance due point for each routine task, the maintenance due point being based upon the control point and the accomplishment data of the routine task;

identifying maintenance due tasks as those routine tasks for which a difference between the maintenance due point of the routine task and the accumulated usage data of the aircraft is less than a user-defined critical value; and

reporting maintenance due tasks.

50. An aircraft maintenance tracking system for tracking aircraft maintenance required for a fleet of aircraft, the system comprising:

means for tracking accumulated aircraft usage data for each aircraft in the fleet of aircraft;

means for receiving, for each aircraft in the fleet of aircraft, a list of routine tasks required to be performed on the aircraft, each routine task having a control point which defines an interval at which the routine task must be performed;

means for tracking task accomplishment data for each routine task;

means for determining a maintenance due point for each routine task, the maintenance due point being based upon the control point and accomplishment data of the routine task;

means for identifying maintenance due tasks as those routine tasks for which a difference between the maintenance due point of the routine task and the accumulated usage data of the aircraft is less than a user-defined critical value; and

means for reporting maintenance due tasks.

51. A method for dynamically planning a maintenance check of an aircraft, the method comprising:

obtaining any routine tasks that may exist, and which are required to be performed on the aircraft;

obtaining any non-routine tasks that may exist, and which are required to be performed on the aircraft;

generating a maintenance flow chart detailing scheduling data for each of the routine and non-routine tasks;

assigning a user-determined number of the routine and non-routine tasks to personnel for completion;

obtaining maintenance activity data on each assigned routine task and non-routine task;

obtaining available resource data; and

updating the maintenance flow chart to reflect newly-obtained maintenance activity data and available resource data.

52. A dynamic aircraft maintenance production system for planning a maintenance check of an aircraft, the dynamic aircraft production system comprising:

means for obtaining any routine tasks that may exist, and which are required to be performed on the aircraft;

means for obtaining any non-routine tasks that may exist, and which are required to be performed on the aircraft;

means for generating a maintenance flow chart detailing scheduling data for each of the routine and non-routine tasks;

means for assigning a user-determined number of the routine and non-routine tasks to personnel for completion;

means for obtaining maintenance activity data on each assigned routine task and non-routine task;

means for obtaining available resource data; and

means for updating the maintenance flow chart to reflect newly-obtained maintenance activity data and available resource data.

53. In a system for dynamically planning a maintenance check of an aircraft, a method for assigning maintenance tasks to crew members of a maintenance crew, the method comprising:

obtaining a dynamic maintenance flow chart detailing up-to-date scheduling data for a predetermined number of maintenance tasks;

obtaining personnel training records for each crew member;

determining maintenance task assignments based upon an analysis of the maintenance flow chart and the personnel training records, each crew member being assigned at least one maintenance task.

54. A method for dynamically planning a maintenance check of an aircraft, the method comprising:

obtaining any maintenance tasks that may exist, and which are required to be performed on the aircraft;

generating a maintenance flow chart detailing scheduling data for each of the maintenance tasks;

obtaining personnel training records for each crew member awaiting task assignment;

determining maintenance task assignments based upon an analysis of the maintenance flow chart and the personnel training records, each crew member being assigned at least one maintenance task.

obtaining maintenance activity data on each assigned routine task and non-routine task;

obtaining available resource data; and

updating the maintenance flow chart to reflect newly-obtained maintenance activity data and available resource data.

55. A system for assigning maintenance tasks to crew members of a maintenance crew during a dynamically-planned maintenance check for an aircraft, the system comprising:

means for obtaining a dynamic maintenance flow chart detailing up-to-date scheduling data for a predetermined number of maintenance tasks;

means for obtaining personnel training records for each crew member;

means for determining maintenance task assignments based upon an analysis of the maintenance flow chart and the personnel training records, each crew member being assigned at least one maintenance task.

56. In a system for dynamically planning a maintenance check of an aircraft, a method for recording and analyzing reliability data for the aircraft, the method comprising:

obtaining and logging warranty-based reliability data from maintenance records generated during the performance of any routine or non-routine tasks that may exist, and which pertain to rotable parts of the aircraft;

obtaining and logging maintenance program-based reliability data from maintenance records generated during the performance of any non-routine tasks that may exist;

identifying for each non-routine task, a routine task whose performance resulted in the generation of the non-routine task;

obtaining and logging maintenance program-based reliability data from maintenance records generated during the performance of any identified routine tasks that may exist; and

analyzing and reporting the warranty-based reliability data and the maintenance program-based reliability data.

57. A system for recording and analyzing reliability data for an aircraft during a dynamically-planned maintenance check of the aircraft, the system comprising:

means for obtaining and logging warranty-based reliability data from maintenance records generated during the performance of any routine or non-routine tasks that may exist, and which pertain to rotable parts of the aircraft;

means for obtaining and logging maintenance program-based reliability data from maintenance records generated during the performance of any non-routine tasks that may exist;

means for identifying for each non-routine task, a routine task whose performance resulted in the generation of the non-routine task;

means for obtaining and logging maintenance program-based reliability data from maintenance records generated during the performance of any identified routine tasks that may exist; and

means for analyzing and reporting the warranty-based reliability data and the maintenance program-based reliability data.

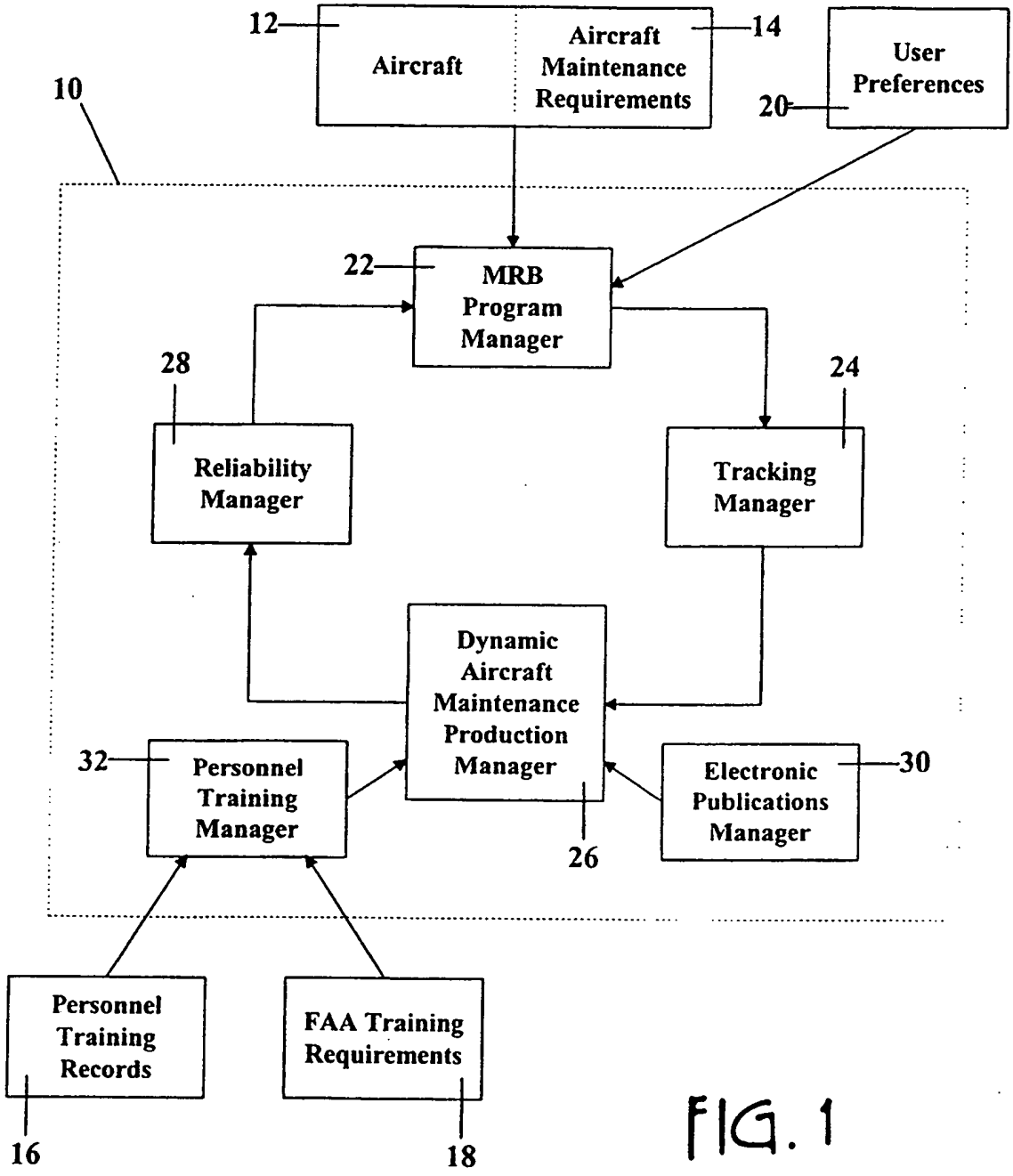


FIG. 1

(SYSTEM OVERVIEW)

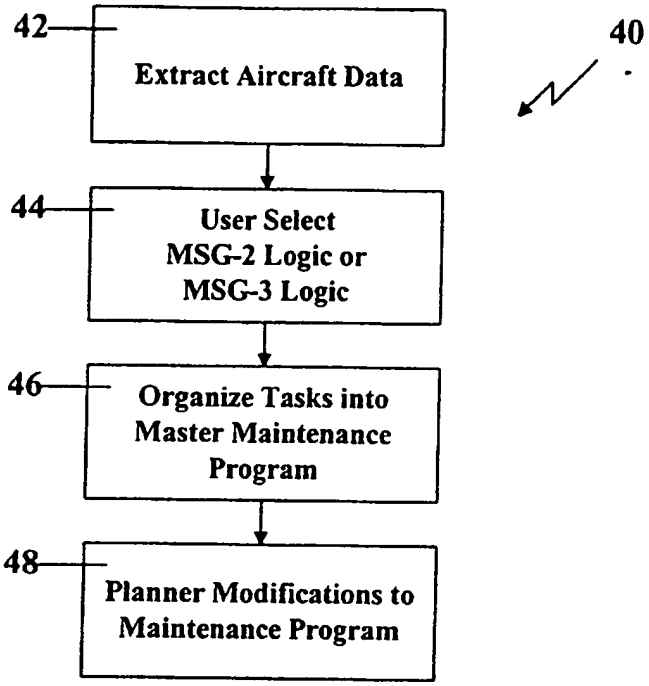
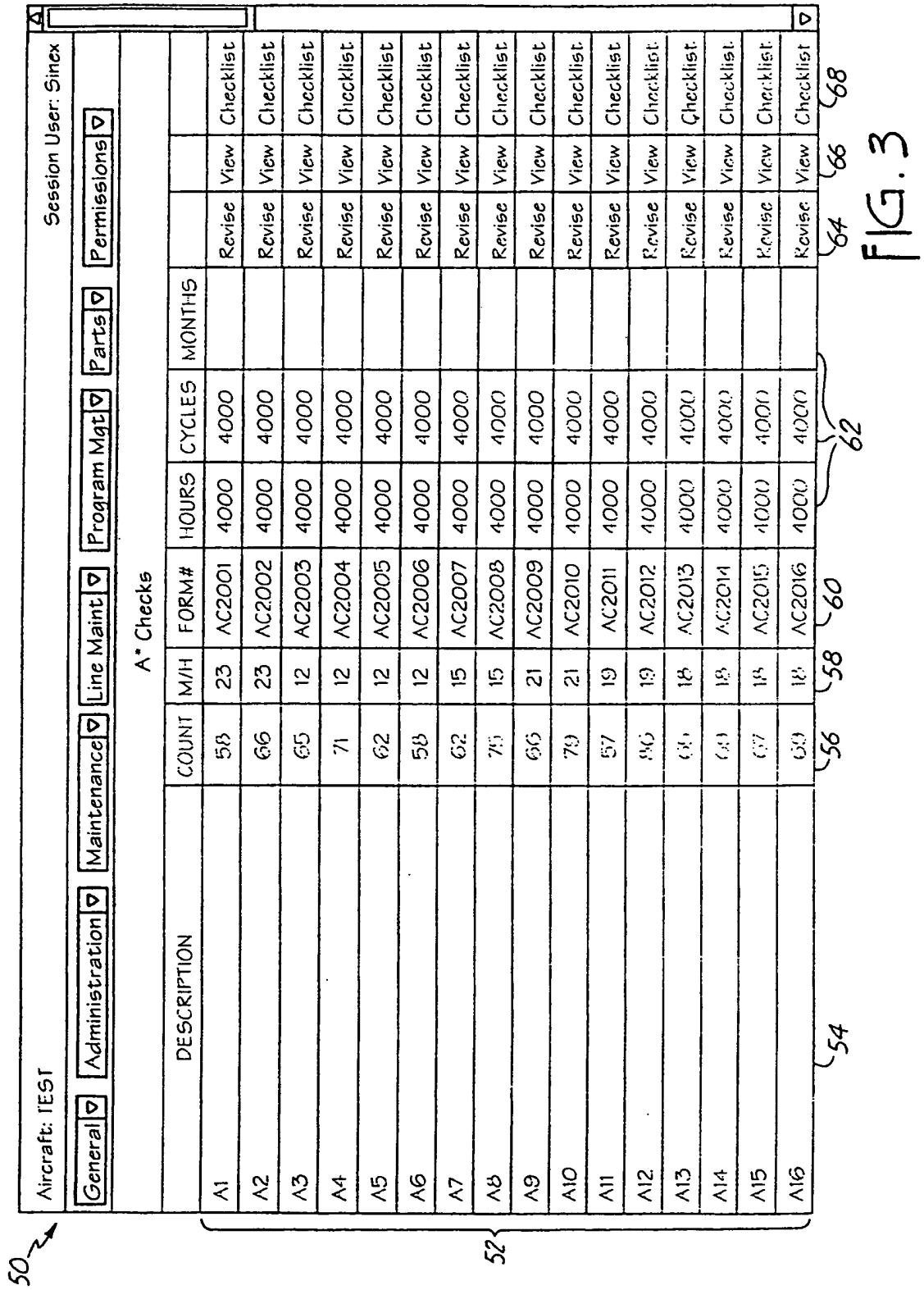


FIG. 2
(MRB PROGRAM MANAGER)


50
Aircraft: TEST
Session User: Sinex
General
Administration
Maintenance
Line Maint
Program Mgt
Parts
Permissions
A* Checks
DESCRIPTION
COUNT
M/H
FORM#
HOURS
CYCLES
MONTHS
A1 58 23 AC2001 4000 4000 Revise View Checklist
A2 66 23 AC2002 4000 4000 Revise View Checklist
A3 65 12 AC2003 4000 4000 Revise View Checklist
A4 71 12 AC2004 4000 4000 Revise View Checklist
A5 62 12 AC2005 4000 4000 Revise View Checklist
A6 58 12 AC2006 4000 4000 Revise View Checklist
A7 62 15 AC2007 4000 4000 Revise View Checklist
A8 75 15 AC2008 4000 4000 Revise View Checklist
A9 66 21 AC2009 4000 4000 Revise View Checklist
A10 79 21 AC2010 4000 4000 Revise View Checklist
A11 57 19 AC2011 4000 4000 Revise View Checklist
A12 56 19 AC2012 4000 4000 Revise View Checklist
A13 61 18 AC2013 4000 4000 Revise View Checklist
A14 63 18 AC2014 4000 4000 Revise View Checklist
A15 67 18 AC2015 4000 4000 Revise View Checklist
A16 60 18 AC2016 4000 4000 Revise View Checklist
52
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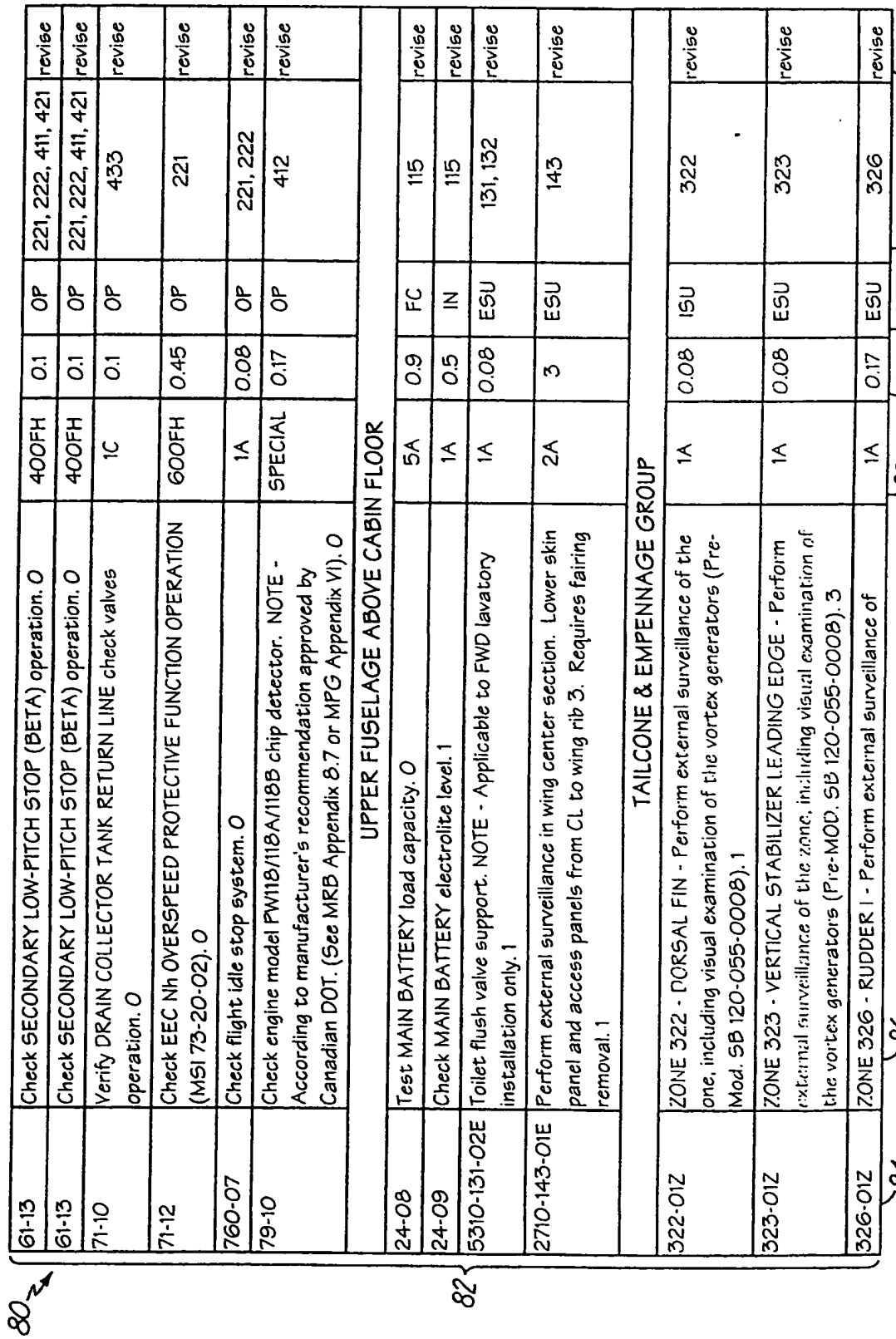
56
58
60
62
64
66
68

FIG. 3



61-13	Check SECONDARY LOW-PITCH STOP (BETA) operation. O	400FH	0.1	OP	221, 222, 411, 421	revise
61-13	Check SECONDARY LOW-PITCH STOP (BETA) operation. O	400FH	0.1	OP	221, 222, 411, 421	revise
71-10	Verify DRAIN COLLECTOR TANK RETURN LINE check valves operation. O	1C	0.1	OP	433	revise
71-12	Check EEC Nh OVERSPEED PROTECTIVE FUNCTION OPERATION (MSI 73-20-02). O	600FH	0.45	OP	221	revise
760-07	Check flight idle stop system. O	1A	0.08	OP	221, 222	revise
79-10	Check engine model PW118/118A/118B chip detector. NOTE - According to manufacturer's recommendation approved by Canadian DOT. (See MRB Appendix B.7 or MPG Appendix VI). O	SPECIAL	0.17	OP	412	revise
	UPPER FUSELAGE ABOVE CABIN FLOOR					
24-08	Test MAIN BATTERY load capacity. O	5A	0.9	FC	115	revise
24-09	Check MAIN BATTERY electrolite level. 1	1A	0.5	IN	115	revise
5310-131-02E	Toilet flush valve support. NOTE - Applicable to FWD lavatory installation only. 1	1A	0.08	ESU	131, 132	revise
2710-143-01E	Perform external surveillance in wing center section. Lower skin panel and access panels from CL to wing rib 3. Requires fairing removal. 1	2A	3	ESU	143	revise
	TAILCONE & EMPENNAGE GROUP					
322-01Z	ZONE 322 - DORSAL FIN - Perform external surveillance of the one, including visual examination of the vortex generators (Pre-Mod. SB 120-055-0008). 1	1A	0.08	ISU	322	revise
323-01Z	ZONE 323 - VERTICAL STABILIZER LEADING EDGE - Perform external surveillance of the zone, including visual examination of the vortex generators (Pre-MOD. SB 120-055-0008). 3	1A	0.08	ESU	323	revise
326-01Z	ZONE 326 - RUDDER 1 - Perform external surveillance of	1A	0.17	ESU	326	revise

80 82 84 86 88 90 92 94 96

FIG. 4

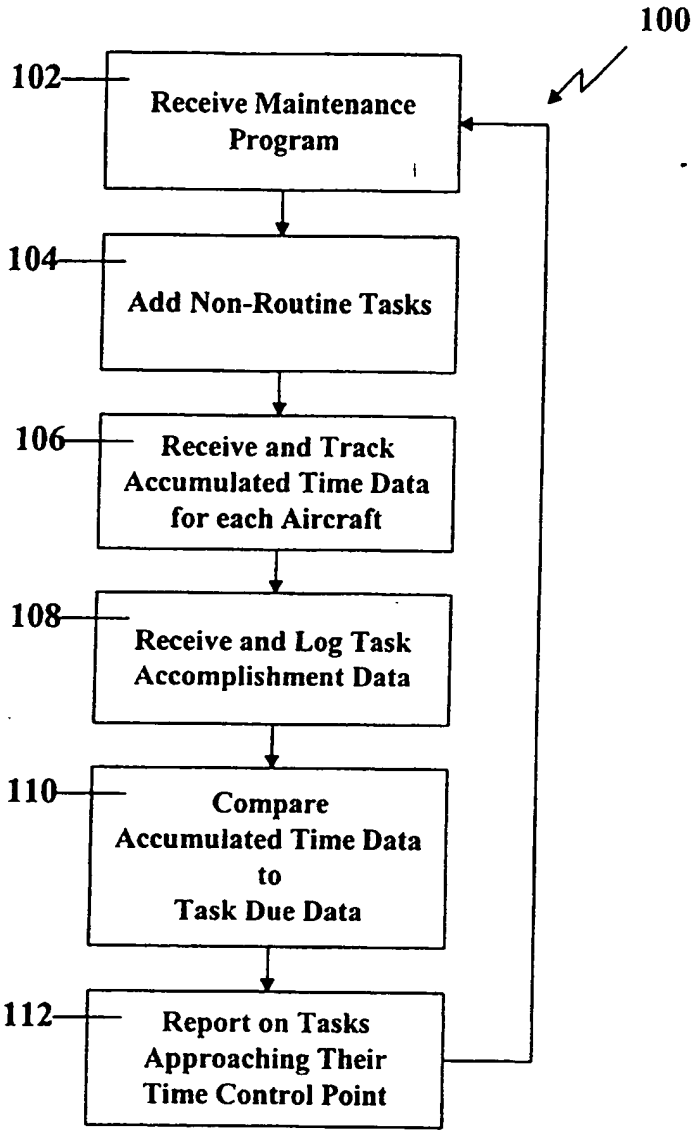


FIG. 5
(TRACKING MANAGER)

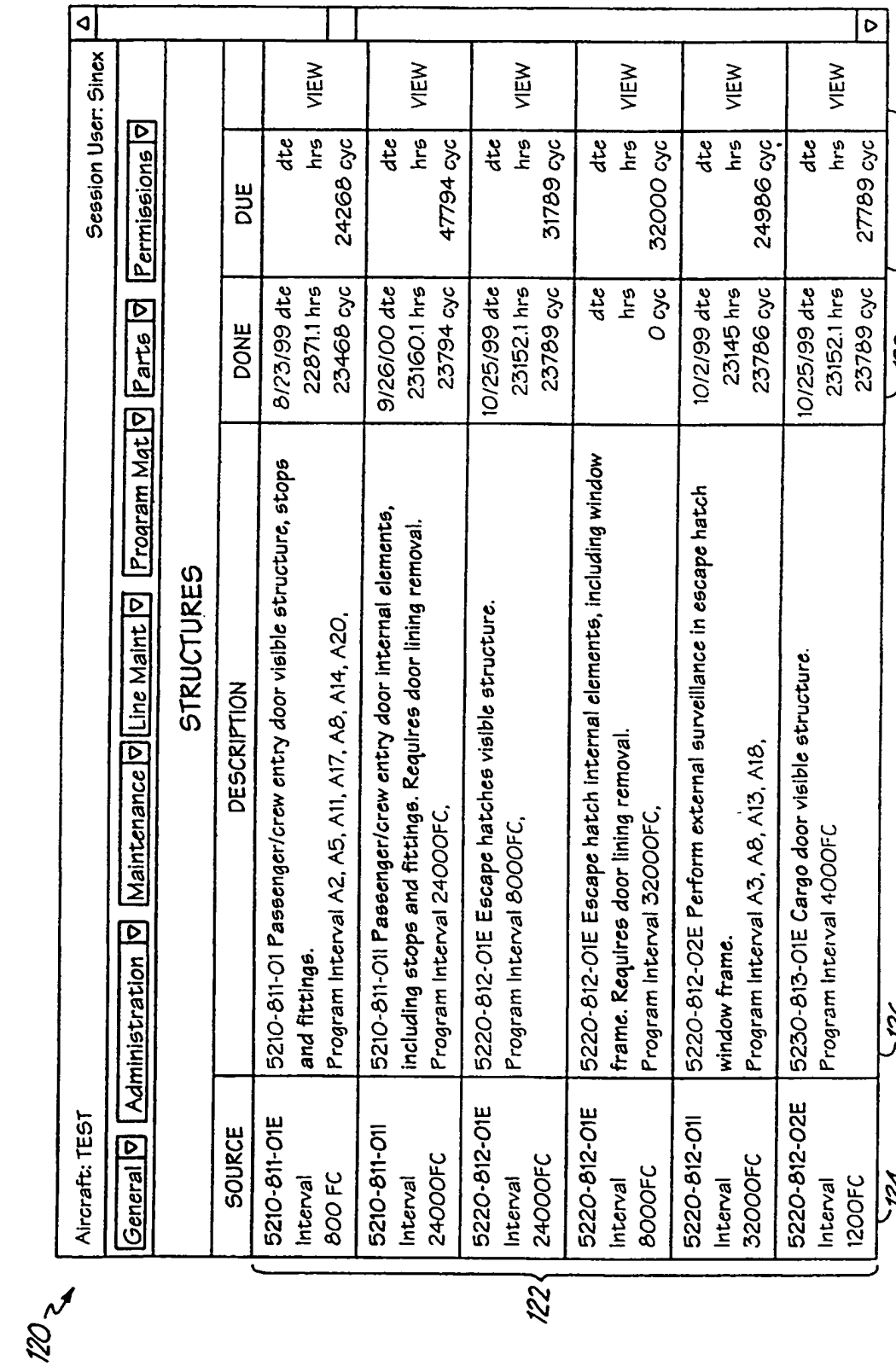

120
Aircraft: TEST
Session User: Sinex
General
Administration
Maintenance
Line Maint
Program Mgt
Parts
Permissions
STRUCTURES
SOURCE
DESCRIPTION
DONE
DUE
5210-811-01E Interval 800 FC
5210-811-01 Passenger/crew entry door visible structure, stops and fittings. Program Interval A2, A5, A11, A17, A8, A14, A20,
8/23/99 dte 22871.1 hrs 23468 cyc
dte hrs 24268 cyc
VIEW
5210-811-011 Interval 24000FC
5210-811-011 Passenger/crew entry door internal elements, including stops and fittings. Requires door lining removal. Program Interval 24000FC,
9/26/00 dte 23160.1 hrs 23794 cyc
dte hrs 47794 cyc
VIEW
5220-812-01E Interval 24000FC
5220-812-01E Escape hatches visible structure. Program Interval 8000FC,
10/25/99 dte 23152.1 hrs 23789 cyc
dte hrs 31789 cyc
VIEW
5220-812-01E Interval 8000FC
5220-812-01E Escape hatch internal elements, including window frame. Requires door lining removal. Program Interval 32000FC,
dte hrs 0 cyc
dte hrs 32000 cyc
VIEW
5220-812-011 Interval 32000FC
5220-812-02E Perform external surveillance in escape hatch window frame. Program Interval A3, A8, A13, A18,
10/2/99 dte 23145 hrs 23786 cyc
dte hrs 24986 cyc
VIEW
5220-812-02E Interval 1200FC
5230-813-01E Cargo door visible structure. Program Interval 4000FC
10/25/99 dte 23152.1 hrs 23789 cyc
dte hrs 27789 cyc
VIEW
122
124
126
128
130
132

FIG. 6

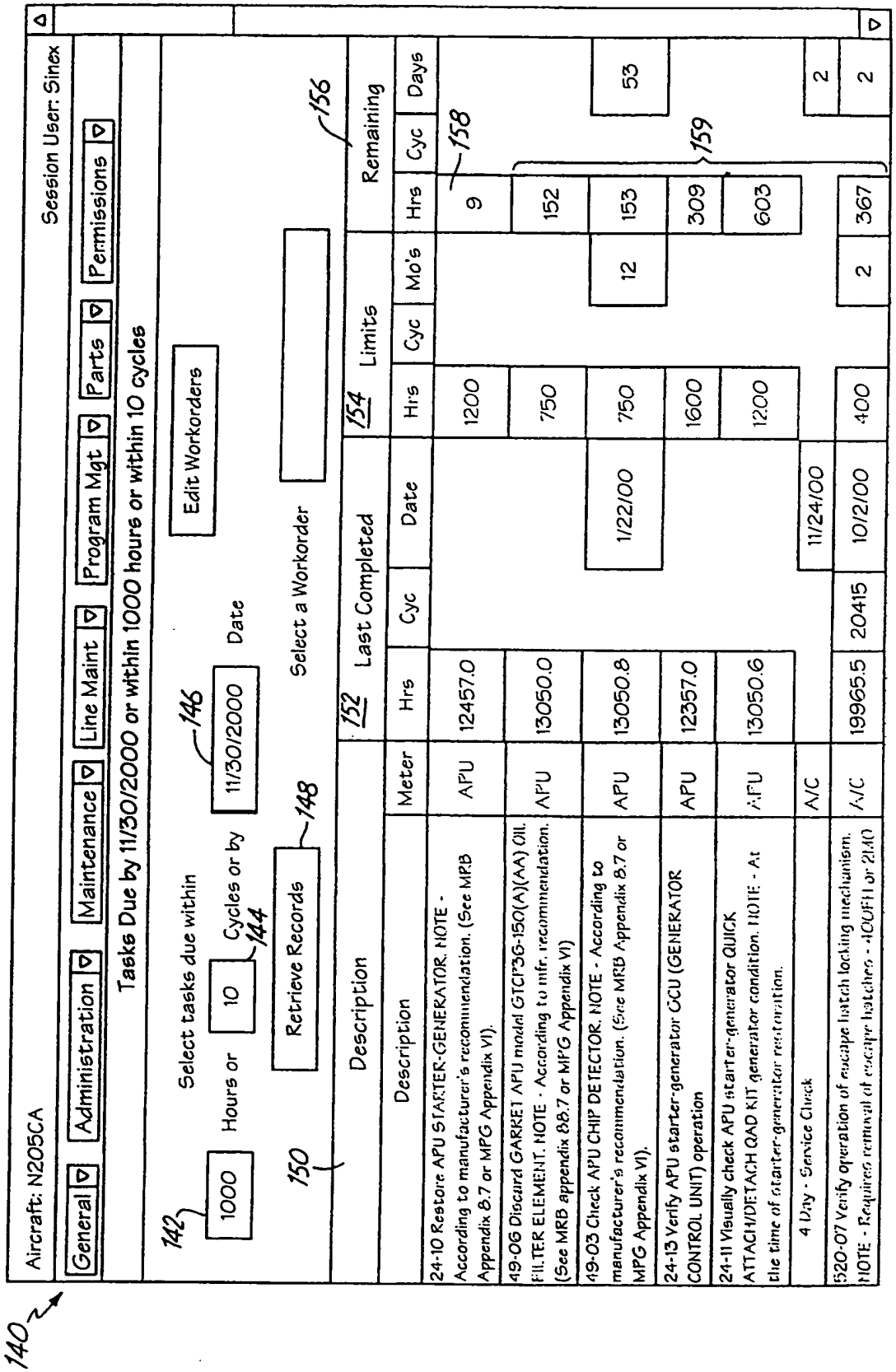

140
Aircraft: N205CA
Session User: Sinex
General
Administration
Maintenance
Line Maint
Program Mgt
Parts
Permissions
Tasks Due by 11/30/2000 or within 1000 hours or within 10 cycles
142
1000
Hours or
Select tasks due within
10
Cycles or by
144
11/30/2000
Date
146
Retrieve Records
148
150
Edit Workorders
Select a Workorder
156
Description
152 Last Completed
154 Limits
Remaining
Description
Meter
Hrs
Cyc
Date
Hrs
Cyc
Mo's
Hrs
Cyc
Days
158
159
24-10 Restore APU STARTER-GENERATOR. NOTE - According to manufacturer's recommendation. (See MRB Appendix 8.7 or MPG Appendix VI).
APU
12457.0
1200
9
49-06 Discard GARRET APU model GTCP36-150(A)(AA) OIL FILTER ELEMENT. NOTE - According to mfr. recommendation. (See MRB appendix 88.7 or MPG Appendix VI)
APU
13050.0
750
152
49-03 Check APU CHIP DETECTOR. NOTE - According to manufacturer's recommendation. (See MRB Appendix 8.7 or MPG Appendix VI).
APU
13050.8
1/22/00
750
12
153
53
24-13 Verify APU starter-generator CCU (GENERATOR CONTROL UNIT) operation
APU
12357.0
1600
309
24-11 Visually check APU starter-generator QUICK ATTACH/DETACH QAD KIT generator condition. NOTE - At the time of starter-generator restoration.
APU
13050.6
1200
603
4 Day - Service Check
A/C
11/24/00
2
520-07 Verify operation of escape hatch locking mechanism. NOTE - Requires removal of escape hatches - 4OUF11 or 2140
A/C
19965.5
20415
10/2/00
400
2
367
2
2

FIG. 7

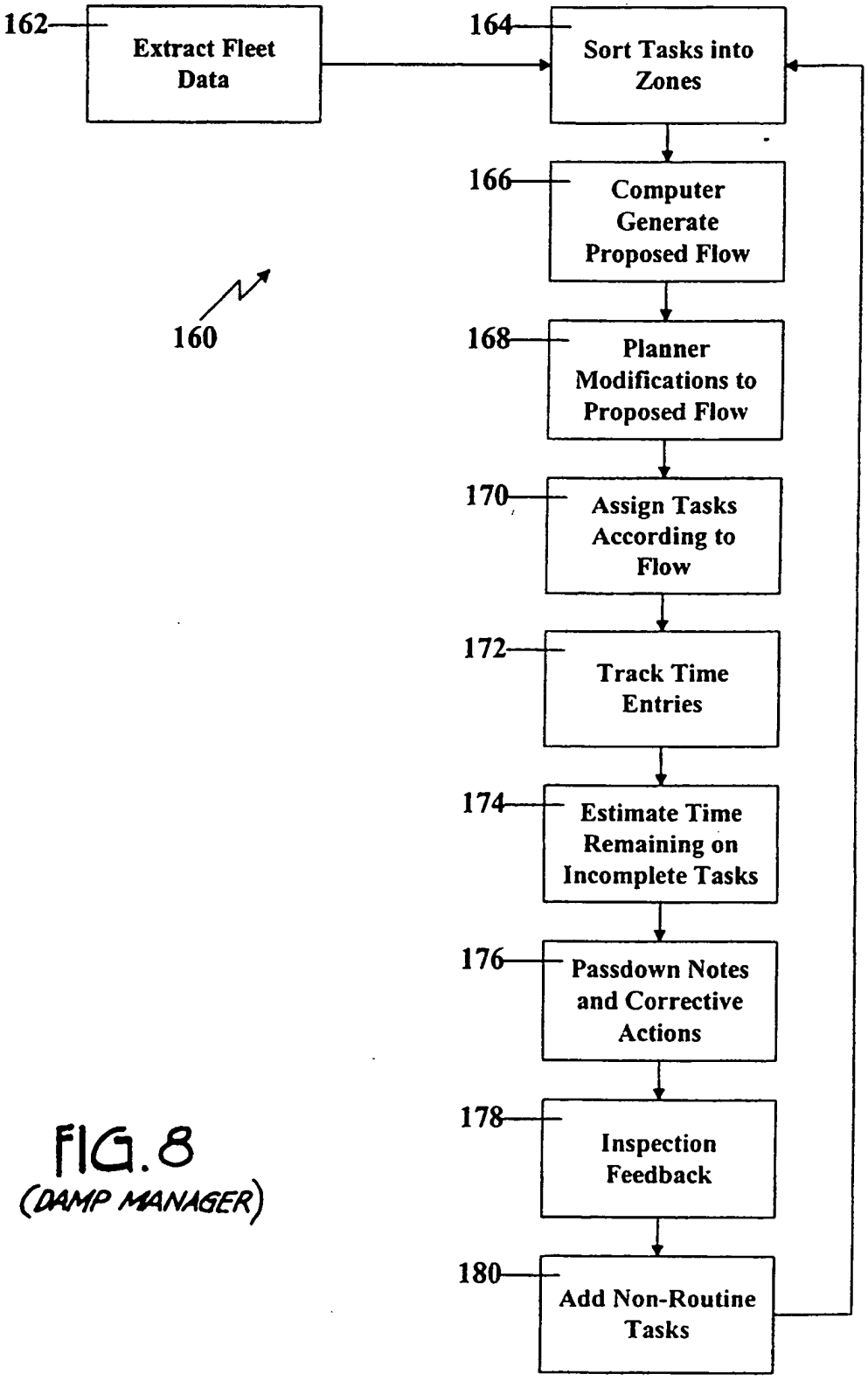


FIG. 8
(DAMP MANAGER)

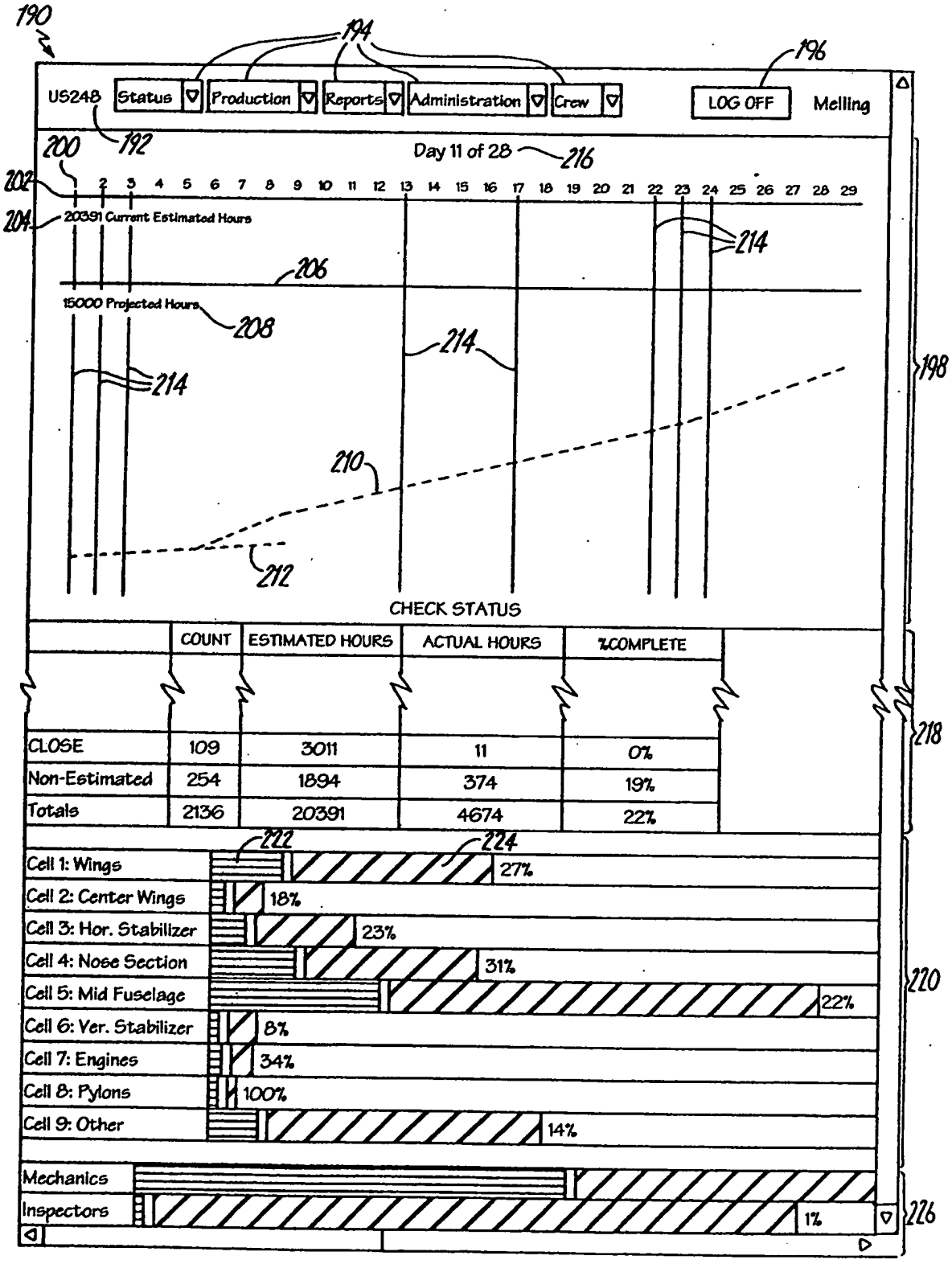

190
194
196
US248
Status
Production
Reports
Administration
Crew
LOG OFF
Melting
200
192
Day 11 of 28
216
202
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
204
20391 Current Estimated Hours
214
206
15000 Projected Hours
208
214
214
198
210
212
CHECK STATUS
COUNT
ESTIMATED HOURS
ACTUAL HOURS
%COMPLETE
CLOSE 109 3011 11 0%
Non-Estimated 254 1894 374 19%
Totals 2136 20391 4674 22%
218
222
224
Cell 1: Wings 27%
Cell 2: Center Wings 18%
Cell 3: Hor. Stabilizer 23%
Cell 4: Nose Section 31%
Cell 5: Mid Fuselage 22%
Cell 6: Ver. Stabilizer 8%
Cell 7: Engines 34%
Cell 8: Pylons 100%
Cell 9: Other 14%
220
Mechanics
Inspectors 1%
226

FIG. 9

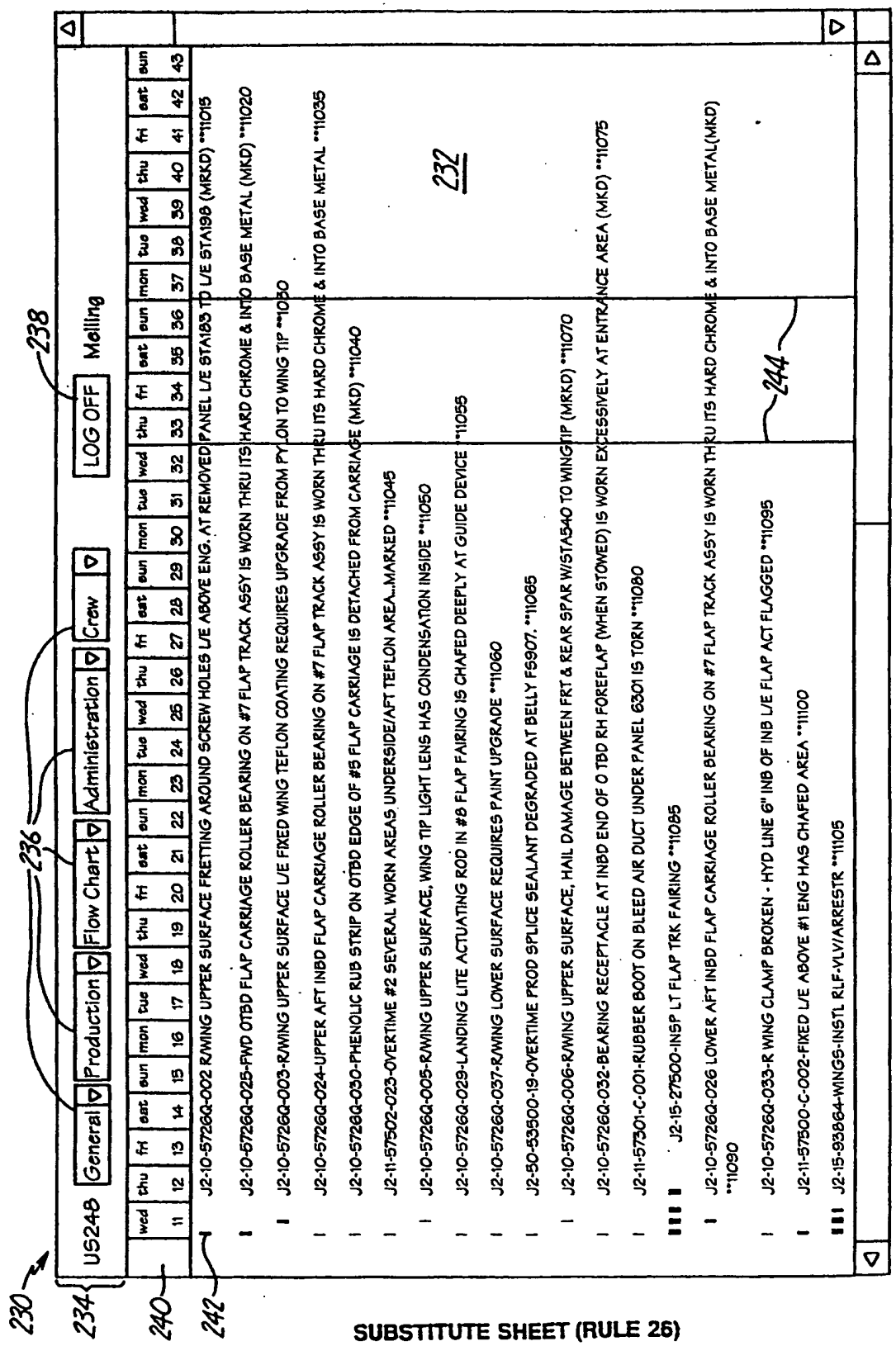

230
234
240
242
236
238
232
244
US248
General
Production
Flow Chart
Administration
Crew
LOG OFF
Milling
wed thu fri sat sun mon tue wed thu fri sat sun mon tue wed thu fri sat sun mon tue wed thu fri sat sun
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
J2-10-57260-002 R/WING UPPER SURFACE FRETTING AROUND SCREW HOLES L/E ABOVE ENG. AT REMOVED PANEL L/E STA185 TO L/E STA198 (MRKD) **11015
J2-10-57260-025-FWD OTBD FLAP CARRIAGE ROLLER BEARING ON #7 FLAP TRACK ASSY IS WORN THRU ITS HARD CHROME & INTO BASE METAL (MKD) **11020
J2-10-57260-003-R/WING UPPER SURFACE L/E FIXED WING TEFLON COATING REQUIRES UPGRADE FROM PYLON TO WING TIP **11030
J2-10-57260-024-UPPER AFT INBD FLAP CARRIAGE ROLLER BEARING ON #7 FLAP TRACK ASSY IS WORN THRU ITS HARD CHROME & INTO BASE METAL **11035
J2-10-57260-030-PHENOLIC RUB STRIP ON OTBD EDGE OF #5 FLAP CARRIAGE IS DETACHED FROM CARRIAGE (MKD) **11040
J2-11-57502-023-OVERTIME #2 SEVERAL WORN AREAS UNDERSIDE/AFT TEFLON AREA...MARKED **11045
J2-10-57260-005-R/WING UPPER SURFACE, WING TIP LIGHT LENS HAS CONDENSATION INSIDE **11050
J2-10-57260-029-LANDING LITE ACTUATING ROD IN #8 FLAP FAIRING IS CHAFED DEEPLY AT GUIDE DEVICE **11055
J2-10-57260-037-R/WING LOWER SURFACE REQUIRES PAINT UPGRADE **11060
J2-50-53500-19-OVERTIME PROD SPLICE SEALANT DEGRADED AT BELLY FS907. **11065
J2-10-57260-006-R/WING UPPER SURFACE, HAIL DAMAGE BETWEEN FRT & REAR SPAR W/STA540 TO WING TIP (MRKD) **11070
J2-10-57260-032-BEARING RECEPTACLE AT INBD END OF O TBD RH FOREFLAP (WHEN STOWED) IS WORN EXCESSIVELY AT ENTRANCE AREA (MKD) **11075
J2-11-57301-C-001-RUBBER BOOT ON BLEED AIR DUCT UNDER PANEL 6301 IS TORN **11080
J2-15-27500-INSP LT FLAP TRK FAIRING **11085
J2-10-57260-026 LOWER AFT INBD FLAP CARRIAGE ROLLER BEARING ON #7 FLAP TRACK ASSY IS WORN THRU ITS HARD CHROME & INTO BASE METAL(MKD) **11090
J2-10-57260-033-R WING CLAMP BROKEN - HYD LINE 6" INB OF INB L/E FLAP ACT FLAGGED **11095
J2-11-57500-C-002-FIXED L/E ABOVE #1 ENG HAS CHAFED AREA **11100
J2-15-93864-WING5-INSTL RLF-YLV/ARRESTR **11105

FIG. 10

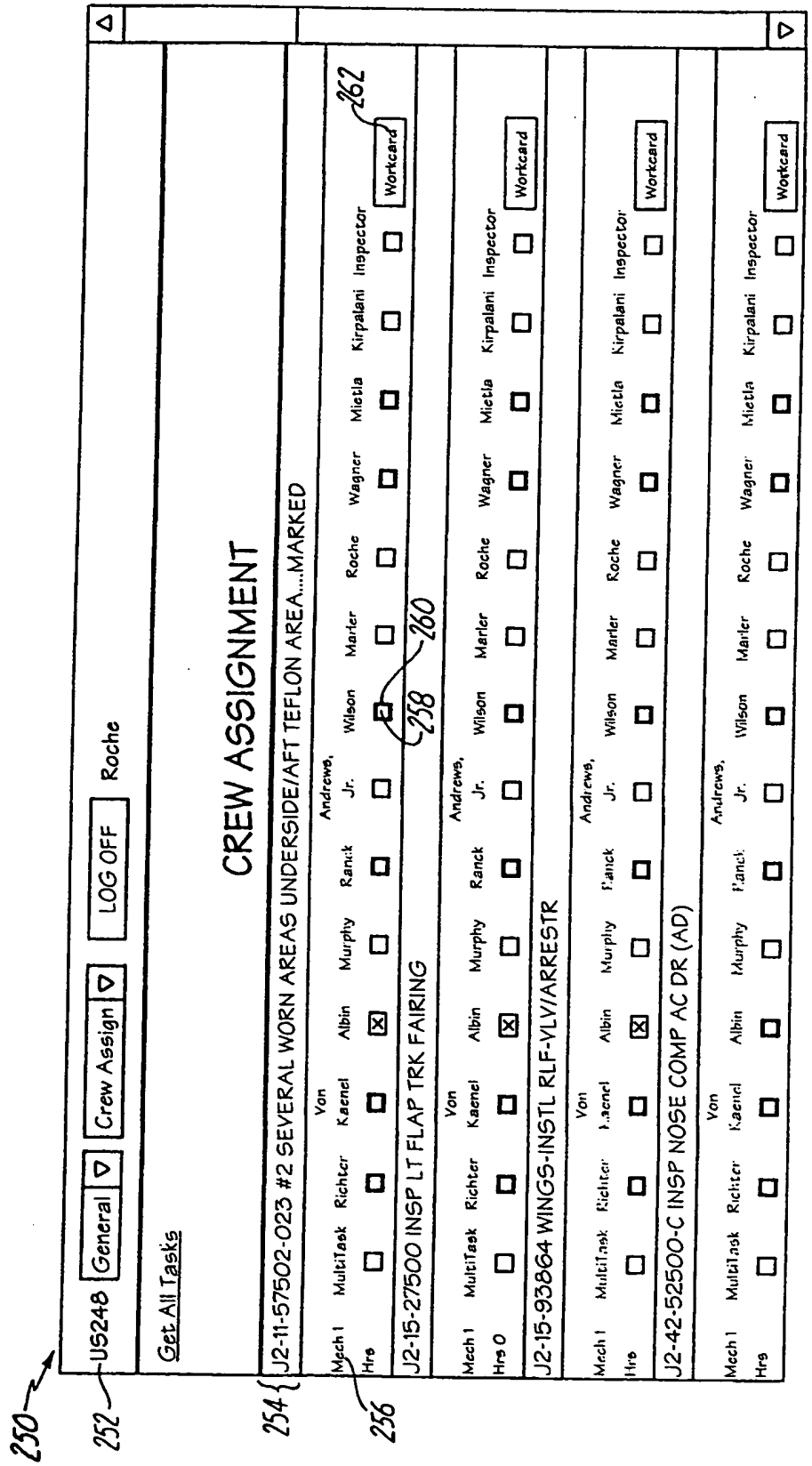

230
252
US248
General
Crew Assign
LOG OFF
Roche
Get All Tasks
CREW ASSIGNMENT
254
256
258
260
262
J2-11-57502-023 #2 SEVERAL WORN AREAS UNDERSIDE/AFT TEFLON AREA...MARKED
J2-15-27500 INSP LT FLAP TRK FAIRING
J2-15-93864 WINGS-INSTL RLF-VLV/ARRESTR
J2-42-52500-C INSP NOSE COMP AC DR (AD)
Mech 1 Hrs
Mech 0 Hrs
MultiTask
Richter
Von Kaenel
Albin
Murphy
Ranck
Andrews, Jr.
Wilson
Marler
Roche
Wagner
Mietla
Kirpalani
Inspector
Workcard

FIG. 11A

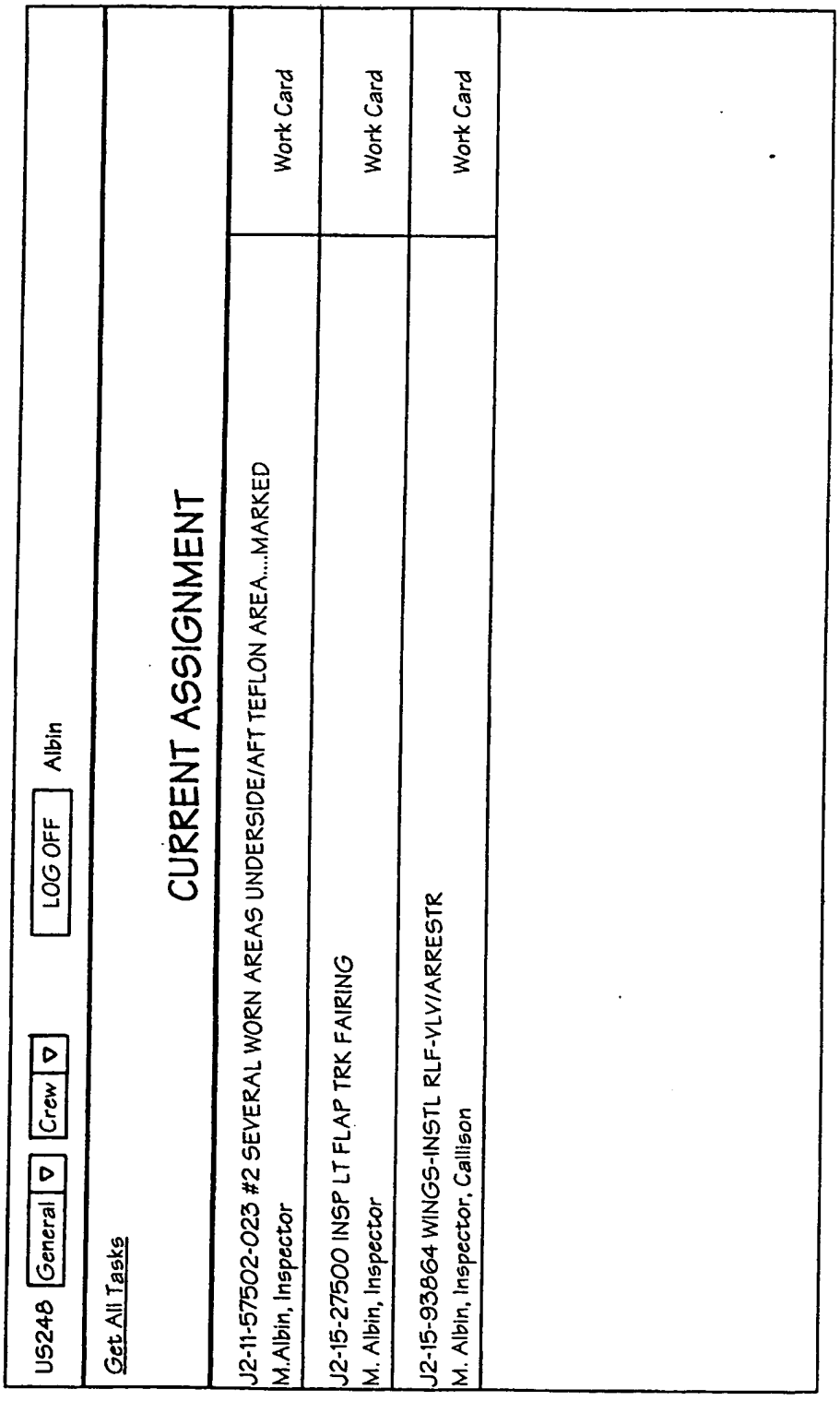
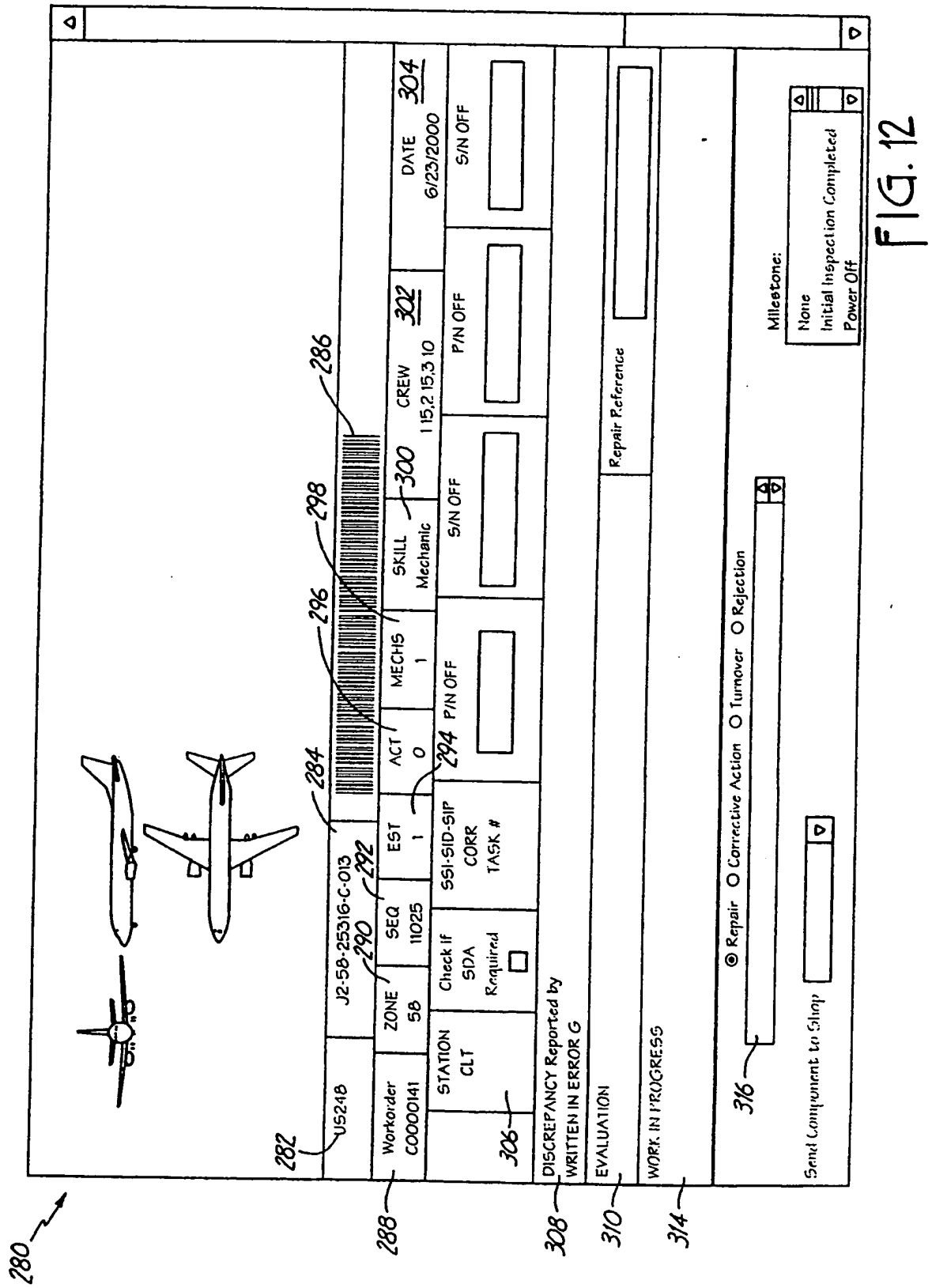

US248
General
Crew
LOG OFF
Albin
Get All Tasks
CURRENT ASSIGNMENT
J2-11-57502-023 #2 SEVERAL WORN AREAS UNDERSIDE/AFT TEFLON AREA....MARKED
M.Albin, Inspector
Work Card
J2-15-27500 INSP LT FLAP TRK FAIRING
M. Albin, Inspector
Work Card
J2-15-93864 WINGS-INSTL RLF-YLV/ARRESTR
M. Albin, Inspector, Callison
Work Card

FIG. 11B


280
282
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292
294
296
298
300
302
304
306
308
310
312
314
316
US248
Workorder C0000141
STATION CLT
ZONE 58
J2-58-25316-C-013
SEQ 11025
Check If SDA Required
EST 1
SSI-SID-SIP CORR TASK #
ACT 0
P/N OFF
MECHS 1
SKILL Mechanic
S/N OFF
CREW 1 15,2 15,3 10
P/N OFF
S/N OFF
DATE 6/23/2000
DISCREPANCY Reported by WRITTEN IN ERROR G
EVALUATION
WORK IN PROGRESS
Repair Reference
Repair O Corrective Action O Turnover O Rejection
Send Component to Shop
Milestone:
None
Initial Inspection Completed
Power Off

FIG. 12

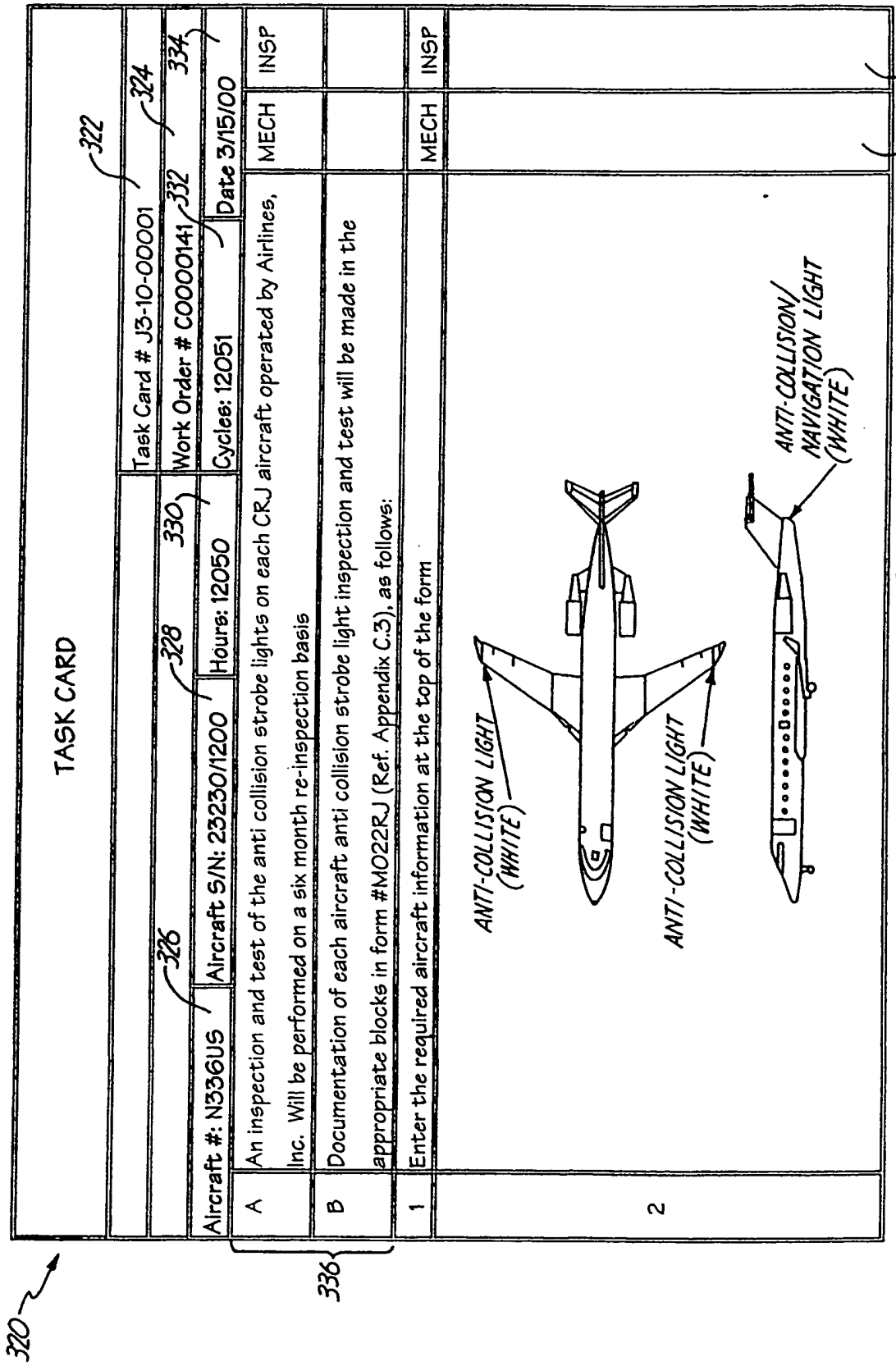
320
TASK CARD
322
Task Card # J3-10-00001
324
Aircraft #: N336US
326
Aircraft S/N: 23230/1200
328
Work Order # C0000141
332
Hours: 12050
330
Cycles: 12051
334
Date 3/15/00
336
A
An inspection and test of the anti collision strobe lights on each CRJ aircraft operated by Airlines, Inc. Will be performed on a six month re-inspection basis
MECH
INSP
B
Documentation of each aircraft anti collision strobe light inspection and test will be made in the appropriate blocks in form #MO22RJ (Ref. Appendix C.3), as follows:
1
Enter the required aircraft information at the top of the form
MECH
INSP
2
ANTI-COLLISION LIGHT (WHITE)
ANTI-COLLISION LIGHT (WHITE)
ANTI-COLLISION/ NAVIGATION LIGHT (WHITE)
338
339

FIG. 13

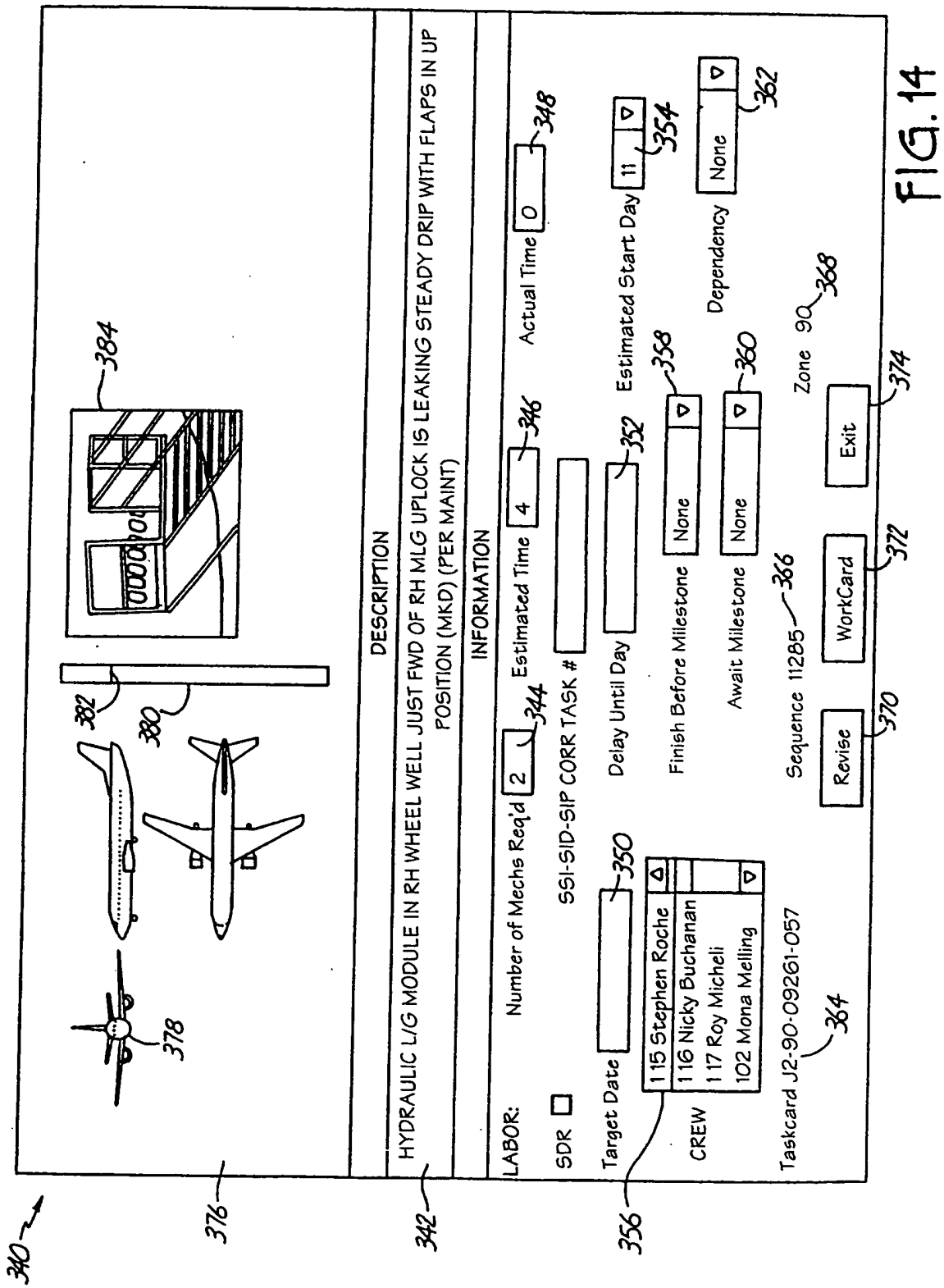
340
376
342
356
DESCRIPTION
HYDRAULIC L/G MODULE IN RH WHEEL WELL JUST FWD OF RH MLG UPLOCK IS LEAKING STEADY DRIP WITH FLAPS IN UP POSITION (MKD) (PER MAINT)
INFORMATION
LABOR:
Number of Mechs Req'd 2
344
Estimated Time 4
346
Actual Time 0
348
SDR
SSI-SID-SIP CORR TASK #
Delay Until Day
352
Estimated Start Day 11
354
Target Date
350
Finish Before Milestone None
358
Dependency None
362
CREW
1 15 Stephen Roche
1 16 Nicky Buchanan
1 17 Roy Micheli
102 Mona Melling
Await Milestone None
360
Zone 90
368
Sequence 11285
366
Taskcard J2-90-09261-057
364
Revise
370
WorkCard
372
Exit
374
382
380
384
378

FIG. 14

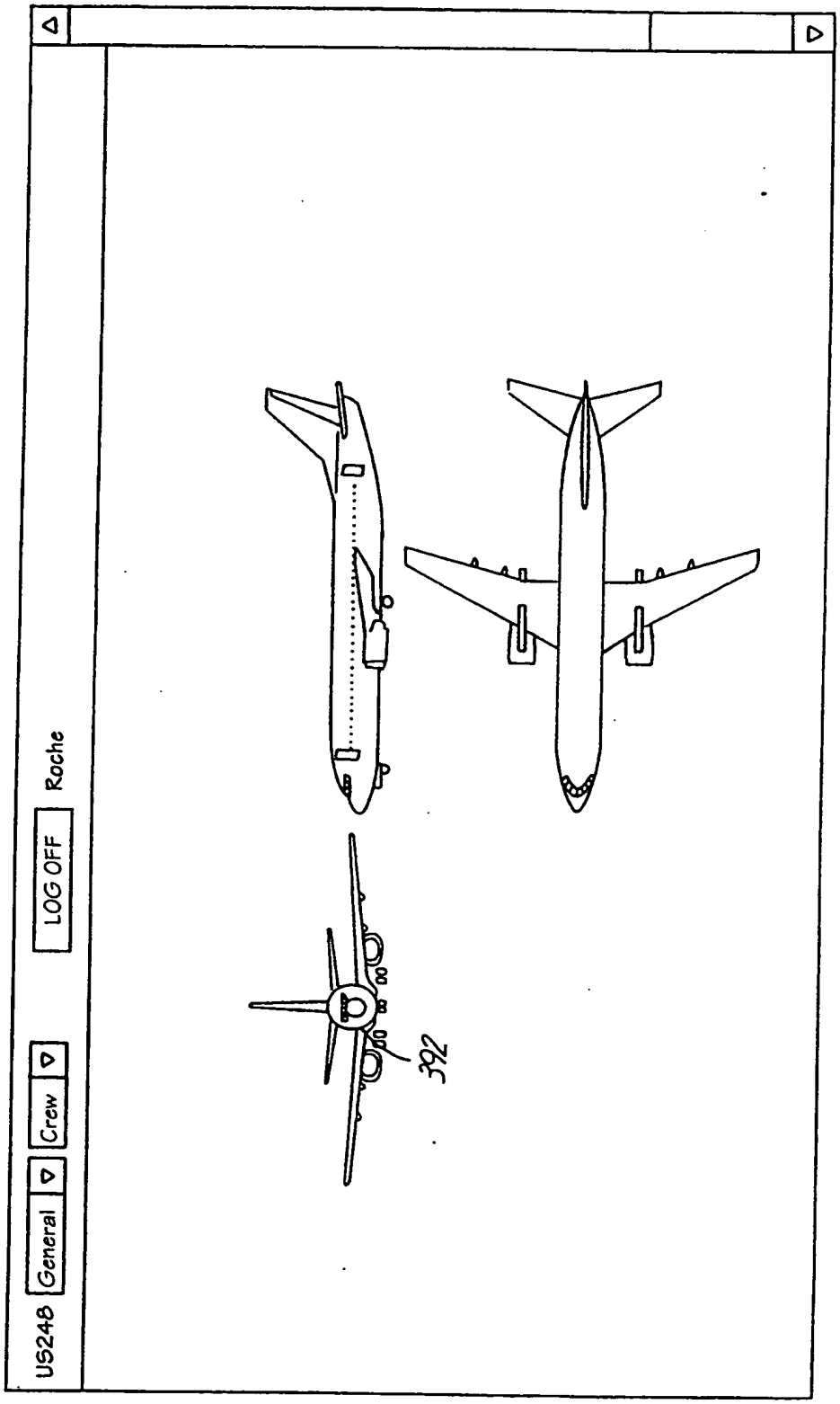

FIG. 15

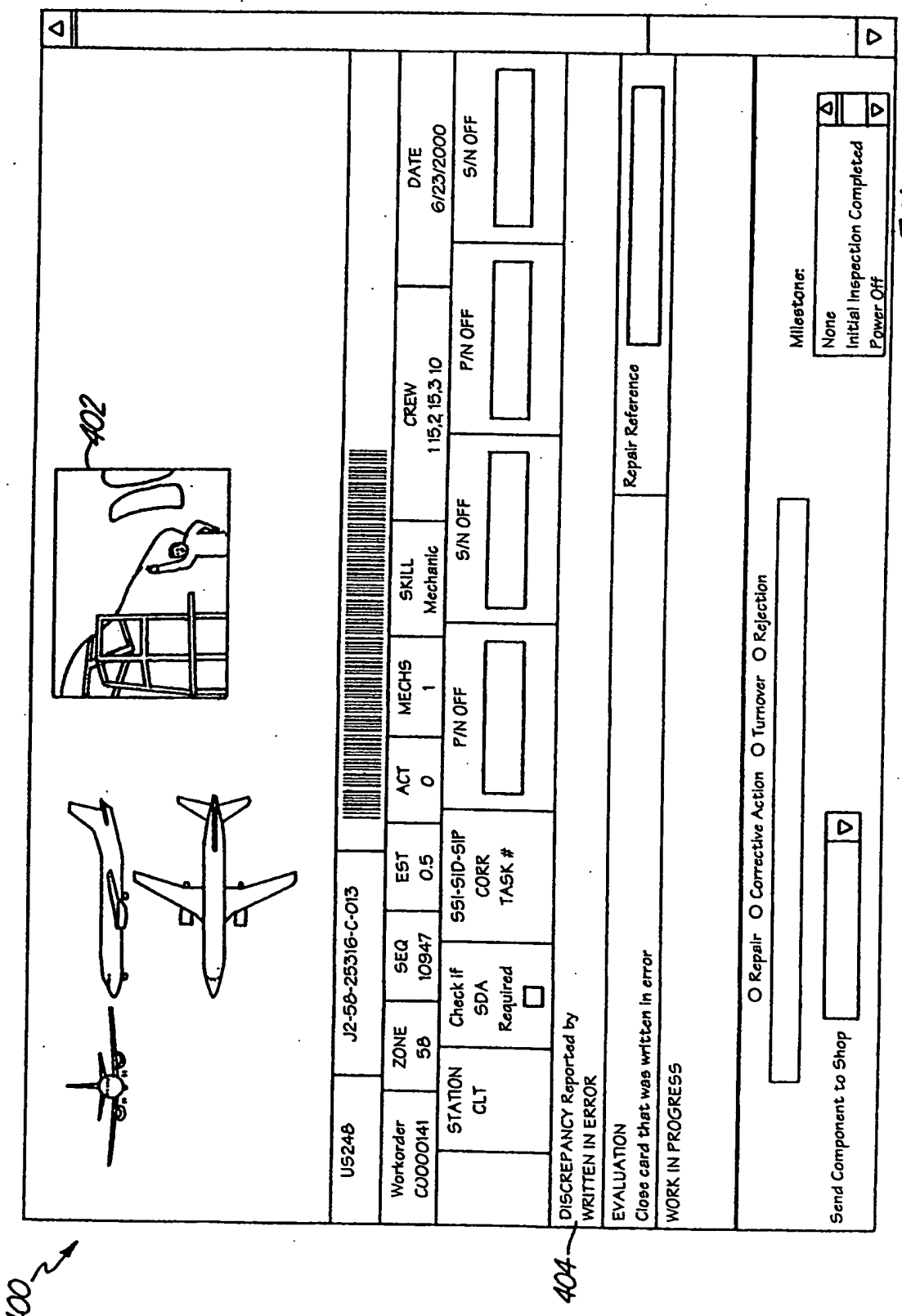
400
402
404
US248
J2-58-25316-C-013
Workorder C0000141
STATION CLT
ZONE 58
Check if SDA Required
SEQ 10947
551-SID-SIP CORR TASK #
EST 0.5
ACT 0
MECHS 1
SKILL Mechanic
CREW 115,2 15,3 10
DATE 6/23/2000
P/N OFF
S/N OFF
P/N OFF
S/N OFF
DISCREPANCY Reported by WRITTEN IN ERROR
EVALUATION
Close card that was written in error
WORK IN PROGRESS
Repair Reference
Milestone:
None
Initial Inspection Completed
Power Off
O Repair O Corrective Action O Turnover O Rejection
Send Component to Shop

FIG. 16

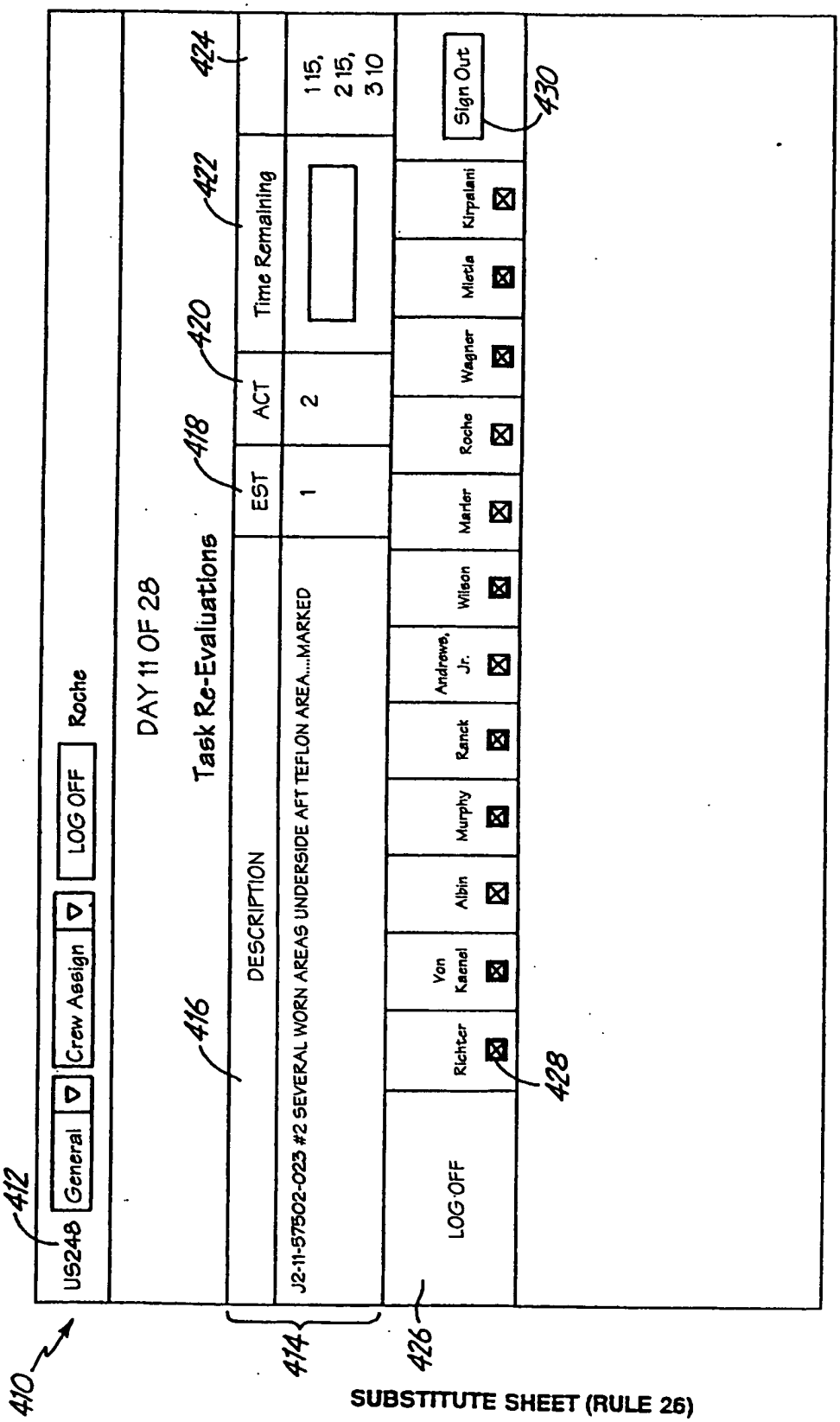
410
412
US248
General
Crew Assign
LOG OFF
Roche
DAY 11 OF 28
Task Re-Evaluations
416
418
420
422
424
DESCRIPTION
EST
ACT
Time Remaining
J2-11-57502-023 #2 SEVERAL WORN AREAS UNDERSIDE AFT TEFLON AREA....MARKED
1
2
1 15,
2 15,
3 10
LOG OFF
Richter
Van Kaenel
Albin
Murphy
Ranck
Andrews, Jr.
Wilson
Marter
Roche
Wagner
Mierda
Kirpalani
Sign Out
414
426
428
430

FIG. 17

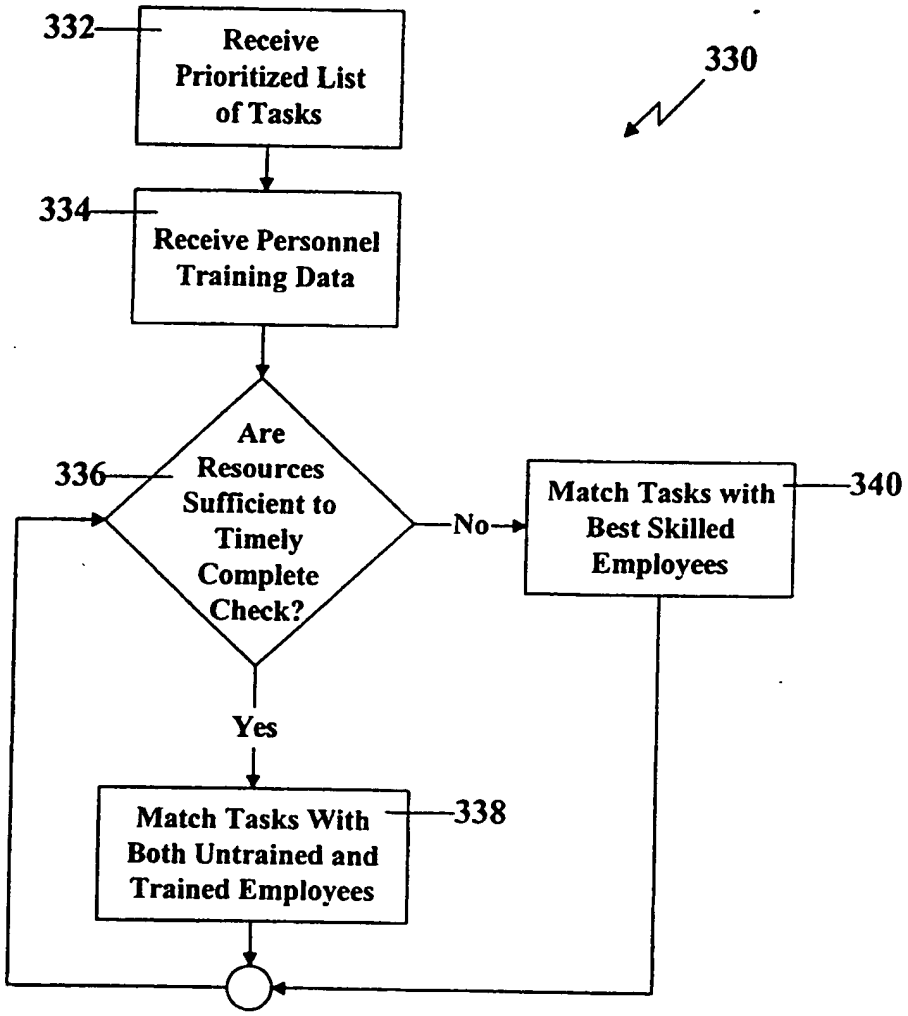

FIG. 18
(AUTO ASSIGN)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/32832

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G06F 17/60
US CL :705/8

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 705/8

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

INTERNET, DIALOG, EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,778,381 A (SANDIFER) 07 July 1998.	1-57
Y	US 5,216,612 A (CORNETT et al) 01 June 1993.	1-57
Y	ANONYMOUS. Ground-support Equipment. Air Transport World. October 1994. Vol. 31. No. 10, pages 107-113.	1-57
Y	American Reduces GSE Costs. Airports International, October 1994. Page 29.	1-57

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 JANUARY 2001	04 APR 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer TARIQ HAFIZ James R. Matthews Telephone No. (703) 305-9643